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Master international de Santé Publique

International survey on risk management policies regarding Radiofrequency Electromagnetic Fields

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ACRONYMS

ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BTS	Base Transceiver Station
CENELEC	European Committee for Electrotechnical Standardization
EFHRAN	European Health Risk Assessment Network on Electromagnetic Fields Exposure
EHC	Environmental Health Criteria
EHESP	Ecole des hautes études en santé publique
EMF	Electromagnetic Field
EU	European Union
FCC	Federal Communications Commission
HCN	Health Council of the Netherlands
HPA	Health Protection Agency
IARC	International Agency for Research on Cancer
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electromagnetic Commission
IEEE	Institute of Electrical and Electronics Engineers
ILO	International Labour Organization
ITU	International Telecommunication Union
MMF	Mobile Manufacturers Forum
MPH	Masters of Public Health
NIR	Non Ionizing Radiation
PPE	Personal Protective Equipment
RF	Radio frequency
SAR	Specific Absorption Rate
ScHARR	School of Health and Related Research
WHO	World Health Organization
WLAN	Wireless Local Area Network

SUMMARY

(In English)

Background: The growth of usage in mobile devices and installations of wireless communications emitting radiofrequency fields and their possible harmful effects on health has provoked public concerns and has promoted many countries to adopt some form of risk management practices and provisions. The main aim of this study was to assess those risk management practices and policies regarding Radiofrequency Electromagnetic Fields around the world. ***Methods:*** This research was carried out as a part of the WHO endeavour to develop the Environmental Health series monograph on radiofrequency fields, in which took place a survey on risk management policies across the world. A total of 71 countries responded to the Survey and information from additional 14 countries was collected via secondary literature search. ***Results:*** A total of 90.6% of respondent countries have exposure limits for fixed installations and 81.5% have exposure limits set for mobile devices that are based either on guidelines from ICNIRP or FCC, an ALARA approach, or evidence-based national limits. It was also seen the countries with a higher proportion of mobile device users tend to adopt evidence-based policies and to provide information on RF risks to mobile device users. ***Discussion:*** There is no regional pattern in terms of adopting national limits for personal and environmental exposures. The tendency to adopt a precautionary approach in some countries is intended to abate public fears; this approach rests on political factors rather than on scientific evidence. Confusion is seen while trying to keep balance between desire to improve the quality of wireless services and the desire to address public concerns on RF EMF.

(en français)

Contexte: La croissance de l'utilisation des appareils mobiles et d'installations fixes émettrices d'ondes radiofréquences et leurs possibles effets nocifs a suscité les préoccupations du public et a encouragé de nombreux pays à adopter certaines pratiques et dispositions de gestion des risques. L'objectif principal de cette étude était de décrire ces pratiques de gestion des risques et les politiques relatives aux champs électromagnétiques radiofréquences à travers le monde. ***Méthodes:*** Cette recherche a été réalisée dans le cadre de l'engagement de l'OMS de produire une monographie de la série Environmental Health Criteria, sur les radiofréquences, qui a conduit à la réalisation d'une enquête sur les politiques de gestion des risques dans le monde. Un total de 71 pays ont répondu à l'enquête et des informations complémentaires ont été obtenues pour 14 pays par la recherche de la littérature secondaire. ***Résultats:*** Un total de 90,6% des pays répondants ont des limites d'exposition pour les d'installations fixes et 81,5% ont des limites d'exposition pour les appareils mobiles, qui sont basées soit sur les recommandations de l'ICNIRP ou de la FCC, sur une approche ALARA, ou sur des limites nationales fondées sur des données scientifiques. Il a également été observé que les pays ayant une plus grande proportion d'utilisateurs d'appareils mobiles ont tendance à adopter des politiques fondées sur des données probantes pour l'établissement de limites d'exposition et ont tendance à fournir des informations sur les risques RF aux utilisateurs d'appareils mobiles. ***Discussion:*** Il n'existe pas de modèle régional en termes d'adoption des limites pour l'exposition aux ondes associées aux appareils mobiles ou aux installations. La tendance à adopter une approche de précaution dans certains pays vise à réduire les craintes du public ; elle repose sur des considérations politiques plutôt que sur des preuves scientifiques. On observe une difficulté à trouver l'équilibre entre le désir d'améliorer la qualité des services sans fils et celui de répondre à l'inquiétude du public sur les champs électromagnétiques RF

1. INTRODUCTION

In the recent years, the use of cellular mobile phones has seen an unprecedented growth with a staggering figure of 6.8 billion subscriptions globally, which suggests a very high penetration amongst the global population, given the fact that one may have multiple subscriptions (ITU 2013). To maintain enough network coverage for the cellular service a large number of telecommunications towers and mast cells are operational. Majority of these towers are clustered in urban areas and other human settlements, primarily to ensure a good network coverage and the quality of mobile services. These mobile phones and the tower base stations, and other wireless telecommunication technologies run on the range within the electromagnetic spectrum, known as radiofrequency (RF), in between the frequencies ranging from 300 kHz to 300 GHz as shown in the Figure 1

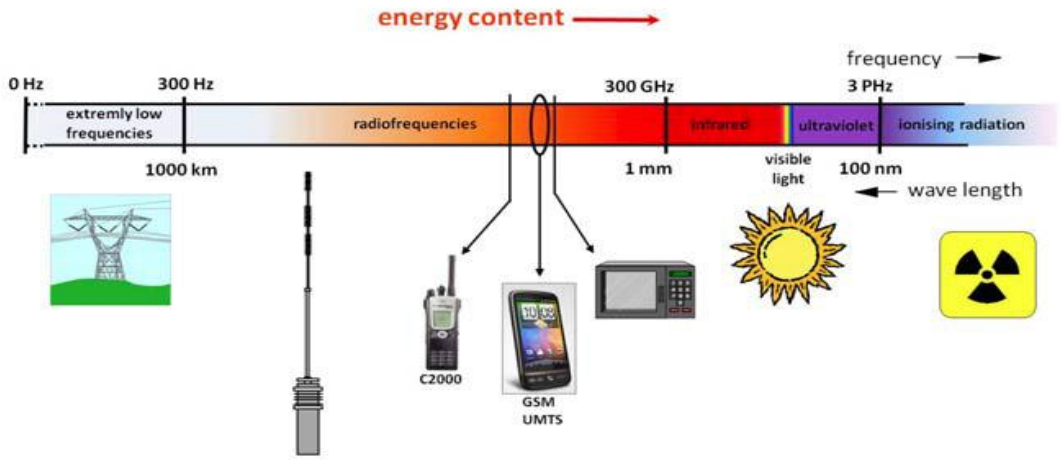

Figure 1: The electromagnetic spectrum; Source: HCN (2011)

The electromagnetic waves or radiofrequency radiation in these spectrum are non-ionising radiation (NIR) as they do not convey an energy capable to extract electrons from atoms and molecules, unlike the ionizing radiation (e.g. gamma rays, x rays). Though traditionally considered to be safer for everyday human contact, the growing field of science has raised an uncertainty by suggesting potential health risks associated with long-term exposure to the radiofrequency electromagnetic fields.

Studies suggest a growth in the number of people complaining of electromagnetic hypersensitivity with declared somatic health symptoms like headache and insomnia associated with exposure to radiofrequency radiations chiefly from the mobile base stations, but these claims have not been substantiated by scientific evidence (Schreier 2006). While there has been adequate evidence documented on thermal or heating effect of electromagnetic radiation, the subject related to the non-thermal effects, like cellular and genetic effects, from the exposure to electromagnetic radiation remains

contentious (ICNIRP 2012). However, the classification of radiofrequency electromagnetic fields emitted through cellular mobile phones and base stations as potential carcinogenic by World Health Organization (WHO)'s International Agency for Research on Cancer (IARC) and the growing public concerns over the long-term effect of non ionizing radiation have made it essential for countries to set limits for RF EMF exposure of the public, the level at which there is no risk to be expected based on the available scientific evidence.

The WHO recommends following the limits set by the International committee for non-ionising radiation protection (ICNIRP) in its guidelines on public and occupational exposure limits. As these recommendations from WHO are not legally binding, countries are free to adopt ICNIRP reference or equivalent (e.g. from the IEEE) levels or more stringent limits, based on the principle of Precaution or an ALARA approach.

There has not been any survey carried out in a global scale to date to describe the principles on which exposure values of the different countries are based upon. At the same time, no study has been carried out to assess the presence or absence of different policies and practices related to radiofrequency electromagnetic radiation to prevent health effects, which justifies the necessity of this study.

The specific objectives of this work are to

- Access the policies and practices on RF EMF and health in relation to personal exposures from RF devices, environmental exposures from fixed installations and to occupational exposures in the work environment.
- Explore regional patterns in terms of provisions for controlling exposure to electromagnetic fields across the six WHO regions.
- Assess whether there is a relationship between the proportion of mobile users in a country and the policy pattern observed in that country
- Conduct a review of the scientific and grey literature to assess the risk management policies on RF EMF.

Research hypotheses

- A regional pattern exists within the WHO regions in terms of adopting policies on personal, environmental and occupational exposure limits for RF EMF emitted by RF devices and fixed installations.
- There is a tendency to adopt exposure limits based on science evidence in countries with higher proportion of mobile phone subscriptions.

- Countries with higher proportion of mobile phone subscribers are more likely to inform or consult with stakeholders regarding the matters related to personal exposure and environmental exposure from RF EMF.

2. METHODS AND MATERIALS

2.1 Collection of the data

This study is primarily based on the international survey on risk management practices related to exposure to RF EMF (for frequency between 100 kHz to 300 GHz) that was undertaken by the Radiation Programme in the Department of Public Health and Environment (PHE) at the WHO in the course of preparation of the Environmental Health Criteria (EHC) monograph on RF EMF.

In summer 2012, WHO developed a comprehensive survey (67 questions, a combination of closed-ended and open-ended questions) in four of the six UN languages (English, French, Spanish, and Russian) around the following RF exposure categories: (i) Personal exposures associated with the use of mobile devices (such as cell phones or baby monitors); (ii) Environmental exposures associated with fixed installations transmitting signals from radio, television and wireless communication networks, and (iii) Occupational exposures in the telecommunication, industrial and medical sectors.

The electronic web survey was conducted through the WHO regional offices which disseminated it to relevant national authorities (health ministry, ministry of telecommunications etc.) who were asked to fill the online survey questionnaire. By the end of the survey period, 71 respondent countries from all six WHO regions filled the questionnaire. For missing responses, a request for supplementary data was sent to 45 countries, out of which 33 provided some information.

A secondary search was carried out, consisting in the review of existing literature on radiofrequency policies in addition of searching for government policy documents. The purpose of this secondary search was twofold: (1) to complement the “missing data” from the WHO survey, and (2) to extract some key information from some countries that did not participate in the WHO survey.

In a first instance, an attempt was made to request those countries to complete the missing or in some case ambiguous answers, but when no response was provided

within the requested time, a search was done via Google by using key words (see Annex 5). Through this process, additional data were retrieved from 5 countries (Ireland, Mauritius, South Africa, New Zealand, and Saudi Arabia).

Second, a search was made to include countries that did not participate in the WHO survey and that have (i) a large population and (ii) a high number of mobile device users. Also, the choice was based on ensuring geographical balance in terms of participation from all WHO regions. The search strategy was similar to the one mentioned above (see Annex 5). We succeeded in retrieving telecommunication guidelines and policy document related to NIR from the dedicated website of four countries (Rwanda, Kenya, Bahrain and Nigeria).

For other countries, only the questions regarding exposure limits from RF devices or exposure limits in the occupational setting could be answered. For the other questions, the response was left blank and included as missing data. Annex 2 shows the list of countries included through secondary search. The search was mainly done in English; as a result, it was not possible to retrieve various country specific policy documents published in regional or national languages. This remains a major limitation for this survey study.

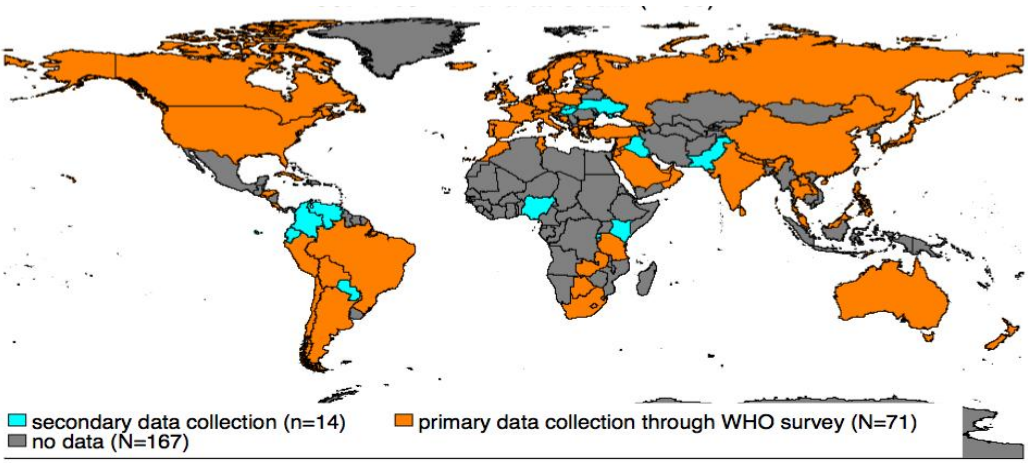

Figure 2: Countries with available data (N=85)

Figure 2 displays the 85 countries that were included in the survey, among them, 10.6 % were from the Africa region, 20 % from Americas, 11.8 % each from Eastern Mediterranean and Western Pacific; 40% from Europe and 5.8% from South East Asia.

2.2 Analysis of the data

This study is primarily descriptive. Counts and mapping of countries that adopt a certain policy are the main results of the analysis, with a component of qualitative data analysis. The multilingual responses (French, Spanish and Russian) were translated

into English and the data received in different formats (csv and word) were rearranged in Excel, and all open-ended questions were converted to a categorical or binomial form. Descriptive and inferential analysis (regression, test of significance, scatterness) were carried out through Stata (version 12.0).

All available data are presented in the form of graphs, tables and figures. To present spatial distribution and to assist visual effectiveness, mapping was done for selected responses, by using the inbuilt mapping software of Stata (version 12.0). To do so, the shape file of world maps were downloaded from www.naturalearthdata.com.

2.3 Literature review on assessment of risk management policies

A qualitative literature review was also carried out to assess the effectiveness of risk management actions and policies regarding RF EMF. The search strategy involved the search of published literature and reports on scientific databases (PubMed, Embase, Medline, Central Cochrane, Cinahl) and sociological databases (SAGE, Cairn, Ebs Cohost) and other open sources like Google, and the EMF-Portal website[1] and via academic and institutional websites for 'grey literature' (see Annex 6 for Key words). Search was limited to data available in English, French, Italian and Spanish. The search was based on the following three topics, namely Assessment of exposure levels, Policy implementation assessment, and Impact on risk perception (see Table V).

3. RESULTS OF THE SURVEY

3.1 Policies on personal exposures from mobile devices

3.1.1 Exposure limits from mobile devices

Human exposure limits from mobile devices are measured in terms of Specific Absorption Rate (SAR) in units of Watts per kilogram body weight.

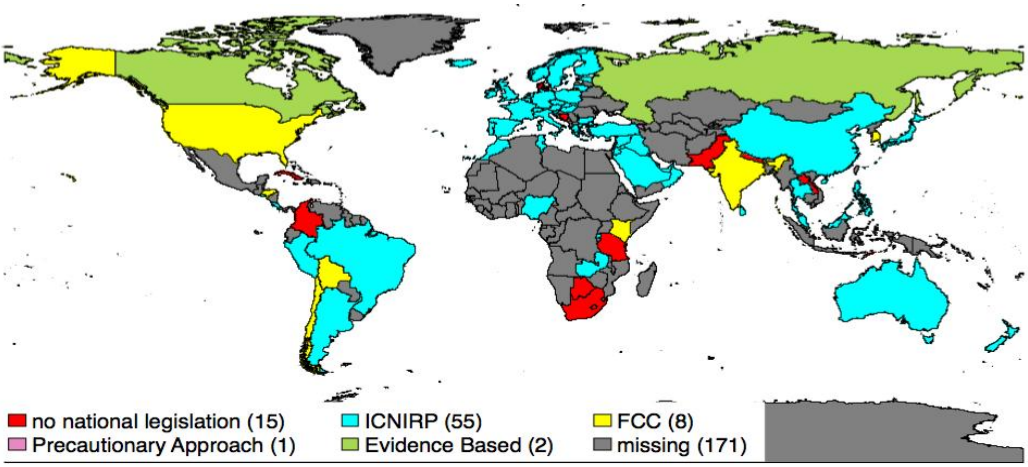

Figure 3: Basis for exposure limit values for mobile devices (N=81)

Among 81 respondents, 14 declared no policy on personal exposure from mobile devices (Figure 3). Among those which have provisions, a total of 62 countries follow the ICNIRP/ IEEE limits (2 W/kg averaged over 10 g of tissue), among which members states of the European Union based on the Radio and telecommunications terminal equipment (R&TTE) Directive. Seven countries follow the FCC limits (1.6 W/kg per gram of tissue in the shape of a cube). Canada has its own evidence-based national limits with values identical to that given by FCC (1.6W/kg). Similarly, Russia has its own evidence-driven exposure based on a power density limit for both near and far fields (100 mW/cm^2; 300-2400 MHz). Armenia whose exposure limits are closely based on Russian limits, has reported to follow the "precautionary principle".

3.1.2 Provisions to inform mobile devices purchasers on RF exposures

A total of 28 countries (36.8% of respondents) declare that they have provisions of advising purchasers on the RF-EMF emissions from mobile devices, and display the SAR values in one or more ways (Table I).

SAR value is displayed (Multiple responses)	N	%
On the device itself	4	14.8
On the packaging box	7	25.9
In the device information pamphlet	19	70.4
On the display shelf	2	7.4
On some internet website	11	40.7

Table I: Ways of displaying SAR values for mobile devices (N=28)

It should be noted that members of the mobile manufacturers forum (MMF) voluntarily provide this information for devices on their website. Countries like France have a provision for displaying SAR values in TV and wall advertisements as well. Netherlands state there is no plan to make it a requirement to inform mobile device purchasers about the SAR value whereas in Tunisia, government is bringing forth a national decree on establishing fixed SAR limits for mobile devices and informing consumers.

3.1.3 Provisions on voluntary limitations of use of mobile phones by children

While nowhere has a complete ban of mobile phone use among children been implemented, 33.3% (N=25) countries had taken voluntary measures to limit the use of mobile phone by children (Figure 4). Among these, 52% (N=13) aim to limit the use of mobile phone among children by providing information to parents, and 3 countries (Russia, France, Zambia) declare that they have set advisory age limits for usage. Figure 4 shows countries that have at least one form of provision regarding the use of mobile phone by children. A total of 12 (48%) countries have restricted usage of mobile phone in schools. In 75% of such cases, the reasons mentioned were educational (i.e. to avoid disturbance in school, to maintain discipline etc.), not in relation with health

concerns. In 3 countries (France, Oman & Spain), there are some forms of limitation of advertising targeting children.

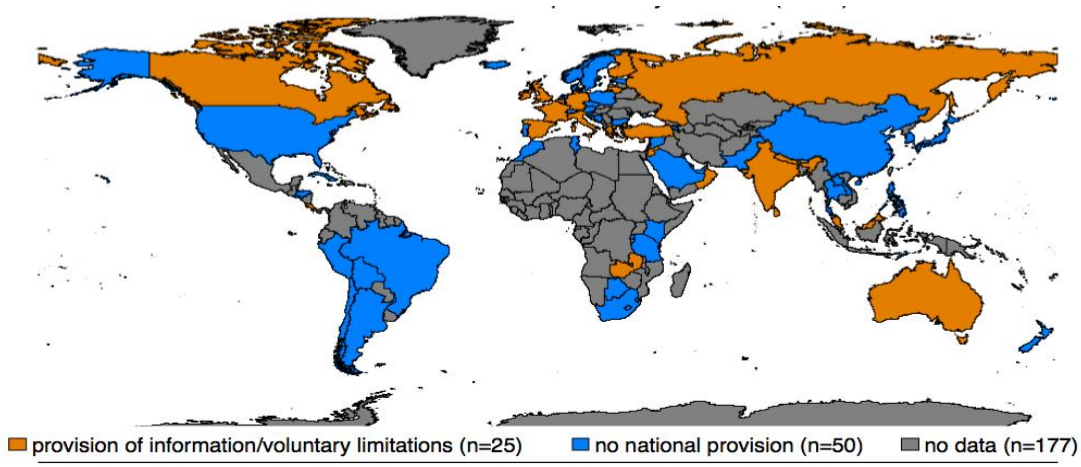

Figure 4: provision of voluntary limitations on mobile devices usage by children (N=75)

3.1.4 Provisions of information on reducing RF exposure by mobile device

Out of 75 respondents, 58.7% (N=44) had provisions to this intent (Figure 5). Almost all (93.2%, N=41) provided messages to the general population and many countries, in addition to the general population, some countries had provision to provide tailored messages to specific population groups: children (54.6%, N=24), pregnant women (20.45%, N=9) and people with biomedical devices (29.6%, N=13) respectively.

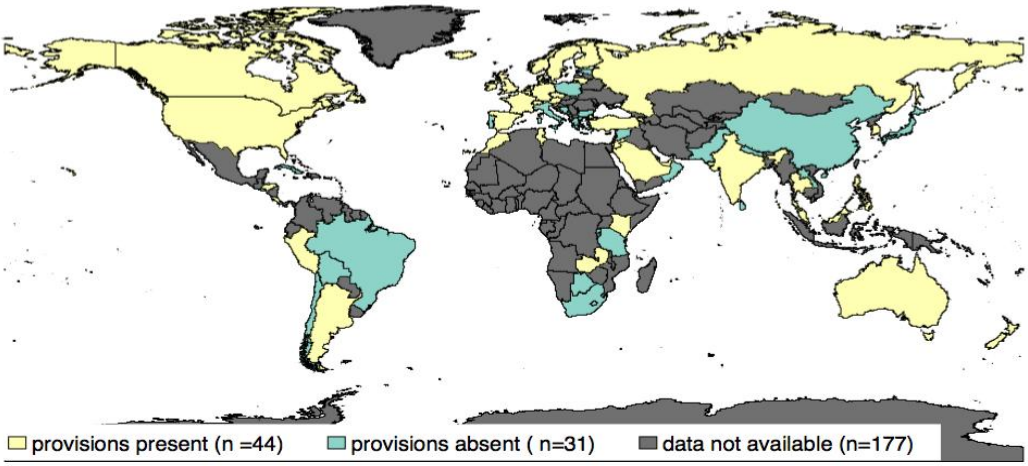

Figure 5: Provisions of information on reducing RF exposure by mobile device (N=75)

In most cases, these messages are delivered directly by a ministry or other national authorities. In less than 3% of the countries, operators of mobile services provided the information. The message includes suggestions to reduce call time (43.2%), to use hands free kits (68.2%), to use texts (34.1%), providing information on SAR and RF studies (29.6%), to avoid calling with low signals (25%) or use phone with low SAR (22.7%) and other responses like suggestions to maintain body/ear distance, and to use an external car antenna.

3.2 Policies on fixed installations

3.2.1 Exposure limits from fixed installations

In Figure 6, out of 85 respondent countries, 90.6% (N=77) have specified the limits for the public for exposures from fixed installations and among these, 71.7% (N=55) follow the ICNIRP limits. Four countries (Armenia, Canada, China and Russia) declare they have set their own evidence-based limits, while two Countries (USA and Trinidad and Tobago) follow the FCC limits. In 16 countries, the exposure limits are lower than the international guidelines, under an ALARA (3.9%) or a precautionary approach (16.9%). Eight countries (Syria, Kiribati, St. Vincent and the Grenadines, Timor Leste, Lao PDR, St. Lucia, Nepal and Tanzania) do not declare exposure limits; all of these countries except Syria have not defined exposure limits for mobile devices either.

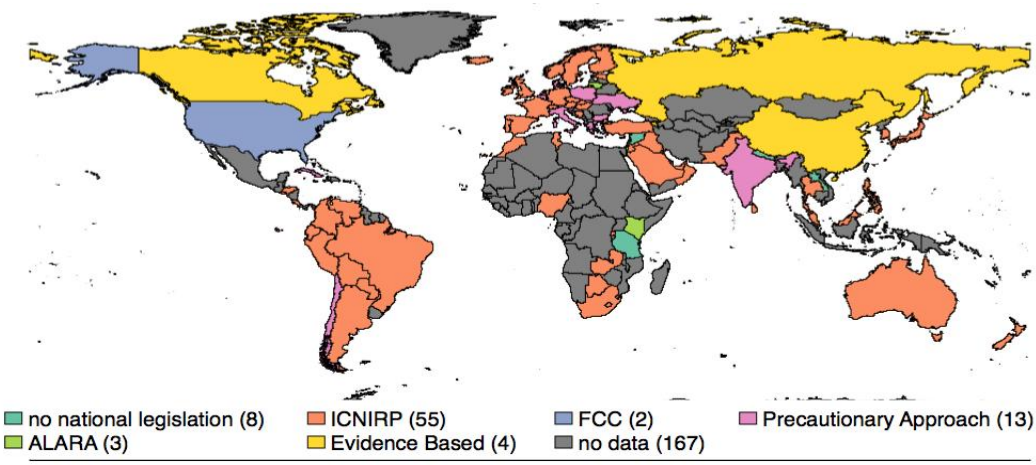

Figure 6: RF exposure limits for the general public from fixed installations (N=85)

A few countries (N=9) declare different rationales for exposure limits for mobile phone and for fixed installations, respectively. China follows ICNIRP limits for mobile device exposures while it has its own evidence-based limits for fixed installations. Three European countries (Belgium, Greece, and Italy) follow ICNIRP limits for mobile devices while they have precautionary limits for fixed installations; Chile and India follows FCC limits for mobile SAR (1.6 W/kg) whereas for fixed installation, they have adopted precautionary approach. Israel and Lithuania follow ICNIRP limits for mobile SAR (2W/kg) but for fixed installations they adopt an ALARA approach. For Canada, the basic whole body SAR restrictions are the same as ICNIRP. In a few instances, the standards may vary within the country, such as in Belgium (with different public exposure limits set for Brussels, and Walloon or Flanders regions).

3.2.2 Requirement for RF measurements around fixed installations

Figure 7 shows that, out of 76 respondents, 78.9% (N=60) countries mentioned that they have provisions to request RF measurements around fixed installation sites.

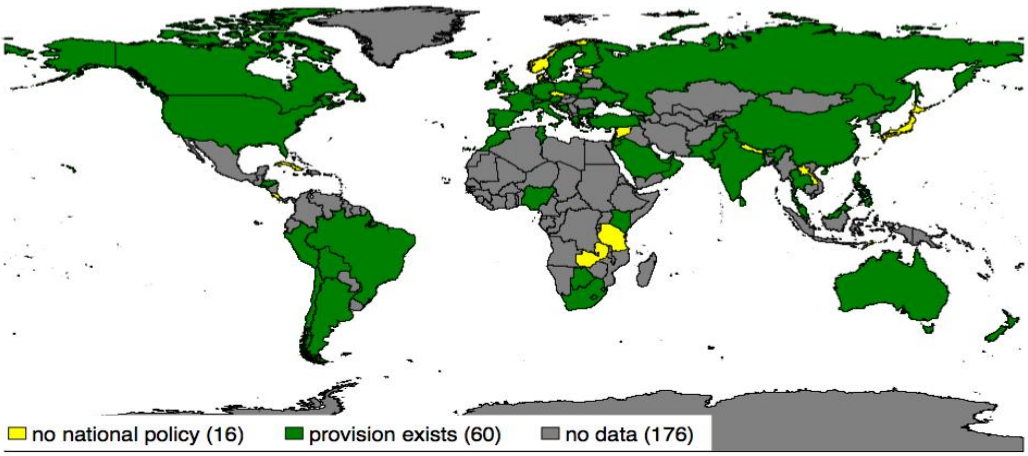

Figure 7: Provisions to request RF measurements around fixed installations (N=76)

In 84.5% (N=49) of those cases the petitioners for requesting RF measurement are the governmental or provincial authorities followed by the concerned community 65.5% (N=38) or local authorities 62.1% (N=36). In 87.9% (N=51) cases the measurements are done by a national agency, but operators can also be responsible for the measurements in 17.2 % (N=10) countries.

In the countries where measurements were requested, only 52.5% (N=31) had accreditation provisions for the measurement service provider and for 47.5% (N=28) countries, RF measurements were requested without any requirement for accreditation.

3.2.3 Requirement for recording RF measurements or modelling estimates

Out of the 59 countries where measurement is requested, recording of exposure measurements or modelling estimates is required in 79.6% (N=47) countries. Three countries (US, Brazil and Morocco) did not report the type of installations concerned. A total of six countries (Belgium, Cyprus, Germany, Lithuania, Slovenia, Switzerland) required the recording of installations emitted in excess of a specified EIRP value.

Installations for which measurement is recorded (N=44)	N	%
All fixed installations (Mobile plus broadcasting)	18	40.9
Fixed installations for mobile only (base station, cellular base stations)	19	43.2
Broadcasting stations (Radio, TV)	12	27.3
Other (smart meter, radars)	2	4.6
Stations emitting beyond a specified value	6	13.6

Table II: Installations for which field measurements are recorded (N=44)

3.2.4 Procedures prior to installing fixed installations

In 80.5% (N=62) countries, a specific authorization is required prior to installing a fixed RF emitting installation. In most cases, this authorization scheme concerns all RF installations (72.6%, N=45), but some countries restricted this scheme to cell phone bases stations according to some criteria (e.g. height, exposure or transmission power limits) or to broadcasting/radio communication Stations. While the requirement for

authorization applies to all locations in the 91.8% (N=56) of the countries where such scheme applies, it can be limited to certain environments such as School (4.9%), Health Care Facilities (6.6%), Residential areas (4.9%) and Public areas (park, cinema, commercial areas) (4.9%). In the 62 countries that have an authorization scheme for fixed installations, a governmental body, at different levels, is the competent authority with authorization power.

3.2.5 Provisions regarding the spatial distributions of the fixed installations

A total of 39 countries (52.7%) have provisions regarding the spatial distribution of fixed installations, while 35 countries (47.3%) do not report any such provision (Figure 8).

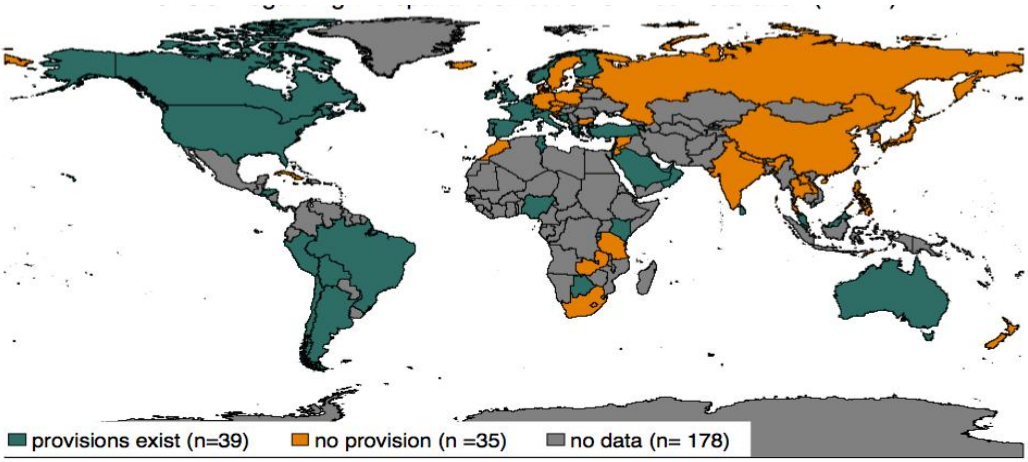

Figure 8: Provisions regarding the spatial distribution of fixed installation (N=74)

Among the 39 countries, 79.5% (N=31) encourage collocation of different operators; 33.3% (N=13) mention that there can be some restriction regarding the siting of planned installations; for example Armenia has the provision to keep the installations on the highest possible places. In Bosnia and Herzegovina, license holder of each installation is required to provide detailed positioning of installations in relation to surrounding objects, corresponding distance and sensitivity of the area to electromagnetic field; Spain prohibits building installations in special protection areas (architectural and landscape). Canada requires a feasibility study for siting of cells based on location and other environmental considerations. Likewise, Israeli authorities consider radiation safety, minimal damage to landscape and efficiency of the construction regarding the siting of installations. In Italy, municipalities have the possibility to define criteria for siting of installations, but they cannot adopt stricter limits than the ones defined at the national level. In Brazil, collocation is required if a new station is to be installed in a distance closer than 500 meters of an existing station.

Among 30.8% of countries (N=12), the allowance for siting of installations is based on environmental and architectural considerations. Provisions based on the height of

installation were mentioned by 17.9% (N=7) of countries, for example in Norway, regulation applies for antennas higher than 3 meters. El Salvador has also mentioned to authorize the siting of cells based on geographical coordinates, tower and antenna heights and the effective radiated power. Switzerland has mentioned that locally different and diverse schemes are possible based on the agreements between communities and the network operators.

3.2.6 Requirements for informing or consulting stakeholders

Among the 72 respondent countries, 44.4% (N=32) mentioned that there were requirements for informing or consulting stakeholders, while 4.2% reported that, though there is no policy requirement to do so, this is practiced universally. The remaining 51.4% (N=37) reported they did not have any such requirement (Figure 9). Stakeholders mentioned were the local community or residents of the building (69.4%, N=25), adjacent land owner (55.6%, N=20), local municipal authority (38.9%, N=14), action groups (25%, N=9). Six countries (Botswana, Nigeria, Malaysia, France, Netherlands & Honduras) include other operators as stakeholders.

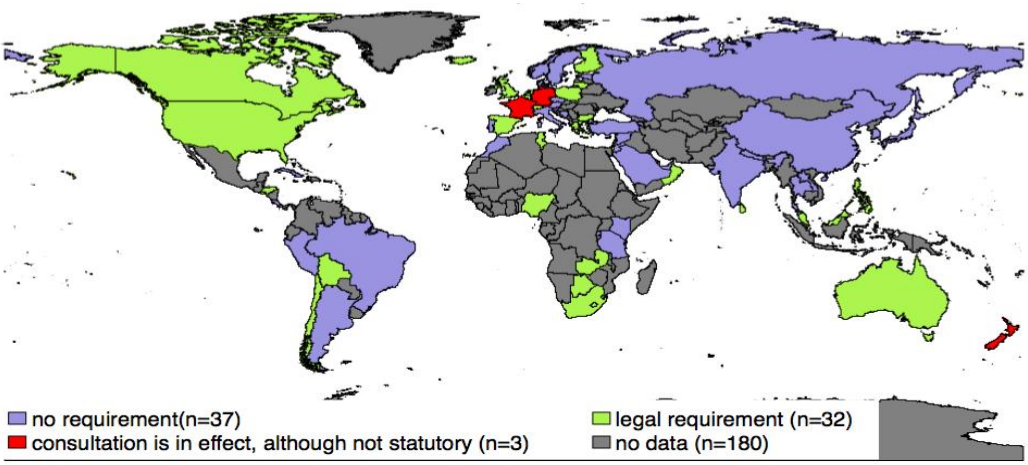

Figure 9: Requirements for informing or consulting stakeholders (N=72)

3.2.7 Provisions to prevent public access to areas around fixed installations

Among the total 74 respondent countries, 56 mentioned that provisions are in place to prevent public access close to fixed installations. The most common provisions are physical barriers (86%) followed by warning signs (75%). In the absence of regulations, operators may implement their own provisions to manage site access both for RF compliance and security. This would not be counted here.

3.2.8 Provision to respond individual concerns on RF from fixed installations

Figure 10 shows that, a total of 55 countries (75.3%) declare that they have provisions in relation of providing responses to concerns from individuals on EMF fields emitted from the fixed installations. Out of those 55 countries, 60% (N=33) provided individualised consultations and responses to complainants, 52.7% (N=29) general

information and factsheets, 34.6% (N=19) offered measurements of EMF radiation to show compliance with exposure standards, and 5.4% (N=3) declared they had provisions to undertake research and epidemiological surveys on EMF.

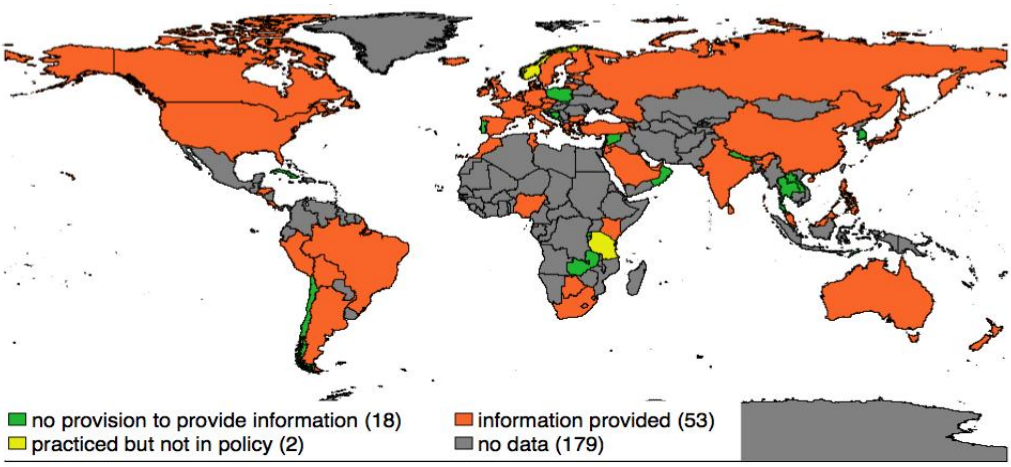

Figure 10: Provision to respond individuals concerned by fixed installations RF fields

Similarly, 25 countries also have provision to provide response to persons claiming to be hypersensitive, 40% (N=10) do so through measurements of RF emission to ensure compliance with limits, 68% (N=17) countries mentioned providing individualised responses based on complaints, which includes discussing measures on how exposures can be reduced as practiced in New Zealand, Russia and Canada. In the Czech Republic, individuals claiming EMF hypersensitivity are answered the self-diagnosis is inaccurate and that there is no evidence of a link with exposure to electromagnetic fields. In 2012, France has started a research project including consultations for people claiming they are hypersensitive. Japan mentioned providing information about the safety and possible health effects of RF-EMF through a telephone consultation.

3.2.9 Provisions of financial contributions for RF research by operators

Only five countries (Spain, India, France, Finland & Australia) have policy for mandatory contribution for EMF research from private service providers or operators, while other countries have voluntary contribution policy (N=4, 5.6%) or no policy at all. Co-funding by the private sector is prerequisite in Finland to get public funding and through this five national research projects were launched since 1994 to study the biological effects of EM fields emitted by wireless communication devices. In Australia, mobile phone service providers, through a levy on their license fees, pay one million dollar annually, most of which is used by the National Health and Medical Research Council to fund EMF research and providing public information on EMF health effects etc. In France, a part of tax from operators, amounting to 2 million Euros per year is

dedicated to EMF research. India uses the money raised from mandatory contribution policy, for research to develop specific norms and standards.

Four countries (the UK, Chile, Switzerland and Germany) encourage contribution or co-funding on a voluntary basis, as in the case of the UK Mobile Telecommunications and the Health Research Programme funded 50:50 between the government and the industry. Italy is the only country to mention that the provision existed in the past but has been discontinued.

3.3 Occupational exposures to RF EMF

3.3.1 Occupational exposure limits

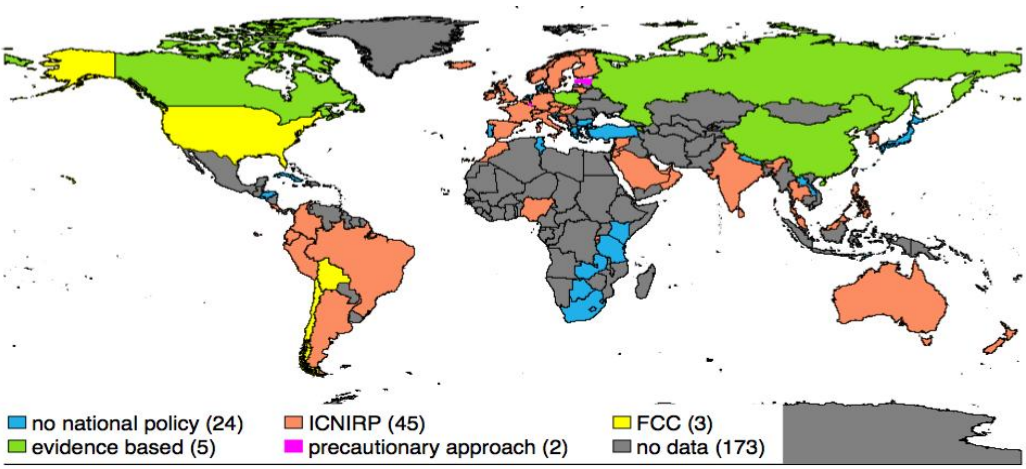

Figure 11: Occupational exposure limits (N=79)

Among 79 countries responding, all but 24 declare they have specified exposure limits for workers exposed to RF fields in their work place (Figure 11). A vast majority follows the ICNIRP or IEEE guidelines. Five countries (Armenia, Canada, China, Poland, and Russia) report to have set their own national limits based on scientific evidence. Two countries (Luxemburg and Estonia) adopted occupational limit values based on a precautionary approach. It is to be noted that EU countries are waiting for the implementation of EU Directive on the minimum health and safety requirements regarding the exposure of workers to electromagnetic fields by the end of 2013. Once, implemented, all EU countries will have a uniform policy regarding Occupational exposure to RF EMF. As for now, the EU countries have their own national limits or they derive from international limits recommended by INCIRP/IEEE and ILO.

3.3.2 Provisions in the telecommunications sector

A total of 56% (N=42) countries out of 75 respondents have provisions to limit exposure of maintenance personnel in the telecom sector. Out of those 62.2% (N=23) reduce the emission level during operations, 75.7% (N=28) mention they shut off the

device, and 67.6% (N=25) instruct workers to use personal protective equipment. Other provisions reported were limitation of exposure duration by 59.5% (N=22), use of warning and signs by 56.8% (N=21) and carrying out risk analysis by 5.4% (N=2).

3.3.3 Provisions in the industry sector

Out of 74 respondent countries, 48.6% (N=36) has such provisions to keep exposure levels below some standard, 86.1% (N=31) do so through engineering measures associated with administrative controls. Also, 91.7% (N=33) have information and training policies to this intent; medical surveillance is reported by 41.7% (N=15), followed by personal protective equipment (PPE) by 36.1% (N=13) and by exposure level inspection or measurements in 38.9% (N=14) of the countries.

3.3.4 Provisions in the medical sector

Among the 49.3 % (N=36) where provisions are said to exist to keep exposure levels below some standard in the medical sector, 78% do so through engineering measures associated with administrative controls. Also, 86% have information and training policies; medical surveillance was reported by 50% countries, followed by PPE (44.4%) and exposure level inspection/measurements (36%).

3.3.5 Prevention provisions for specific groups

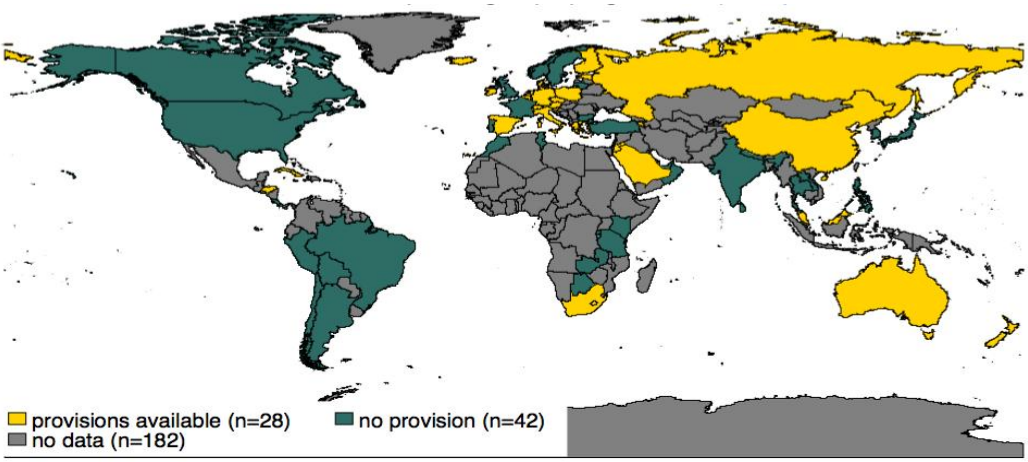

Figure 12: Prevention provisions for specific groups (N =70)

Among the 28 countries with provisions for selected groups of workers like pregnant women, workers with biomedical devices and in some cases workers below 18 years of age, 50% (N=14) have set restrictive exposure limits, which include setting lower limits in accord with those set for the general public. In 39.3 % (N=11) countries, provisions exist to shift exposed jobs for pregnant females and 21.4% (N=6) declare they have provisions to provide paid sick leave if job shifting is not viable (Belgium, Estonia, Germany, Greece, Iceland and Jordan). Other reported measures include training on safety protocols by 28.6%(N= 8), carry out risk assessment by 25%(N=7), restricted

entry in designated areas by 17.9%(N= 5), A few countries mentioned additional precautions for pregnant women, without clarifying the details of those precautions.

4. FINDINGS OF THE LITERATURE REVIEW

4.1 Assessment of exposure levels

Development of measurement and modelling guidelines

The Institute of Electrical and Electronic Engineers (IEEE), the International Electromagnetic Commission (IEC) and the European Committee for Electrotechnical Standardization (CENELEC) provide technical standards, to evaluate the compliance with exposure limits. For occupational exposure assessment, the average measurement uncertainty is estimated to be about 30% [Simunic 2006][2].

Exposure to mobile phone base stations antennas and broadcasting bands

In urban areas, radio waves from mobile phone base stations contribute to the overall environmental exposure to RF EMF [Schüz 2000][3.] Despite the growth of mobile phone subscribers and the advent of 3G technologies, the average exposure to RF/EMF did not change in countries like UK, Spain, Greece, Ireland and USA, as reported by the operators (Rowley 2012). The exposure levels measured in Europe are much under the guidelines limits of ICNIRP or IEEE, ranging between 0.01 and 1 V/M (only 1% above 6 V/m and less than 0.1% above 20V/m) [EFHRAN 2010].

For the purpose of exposure measurement, a majority of countries used mobile devices and modelling techniques [COMOP 2011]4. But in some cases, measurements were done using personal exposure meters e.g. France [Viel 2009b], or hand-held meter, like in Nigeria [Nwankwo 2012] and Korea, where the highest recorded field level reported was 0.15% of ICNIRP guidelines [Kim 2010].

Wi-Fi exposure

A study carried out in UK identified a maximum electric field strength of 5.72 mV m^{-1} at 0.5 m from the source that is within the ICNIRP limits for Wi-Fi radiation [Peyman 2011]. Also, studies highlight that the indoor RF exposure is increasing faster than outdoor exposure, probably due to recent wide spread of home wireless devices [EFHRAN 2010].

Occupational exposure

Exposure to RF-EMF in the office is mainly due to mobile phones, cordless phones, Bluetooth and WLAN emissions [Sandström 2006][5]. In Europe, Directive 2004/40/EC

[European Parliament 2004]6 to be implemented by end of October 2013, deals with limitation of exposure of workers to the risk associated with EMF. The evaluation of workers' exposure is to be performed either by calculation or by measurements. Directly measurable values are averaged over time and space. Usually, exposure is determined in the worst-case scenario [Hansson Mild 2009][7].

4.2 Policy implementation assessment

Mobile phone base stations

A study carried in 2001 in Austria to ensure the compliance with exposure limits of 1 mW/m^2 from base stations, based on a precautionary approach, identified that 61% of the randomly selected antenna sites have exceeded the limit of 1 mW/m^2 by up to a factor of 40. The study concluded that the limit could not be complied with, based on operational and technical reasons and it would be "difficult to achieve exposure values lower than 100 mW/m^2 without substantial economic consequences" [NIR 2002][8].

In Belgium, each region has its own regulation regarding RF-EMF exposure limits. Exposure limits in the Brussels' region are 3 V/m for all frequencies. The stringency of the limits has caused substantial difficulties for the operators in terms of compliance [IBPT 2013][9]. In Germany, a study about broadcasting carried out showed that maximum power density increased after switching from analogue to digital broadcasting (from 0.9 mW m^{-2} to 6.5 mW m^{-2}) [Schubert 2007 in HPA 2012][10]. In Poland, results of radiofrequency EMF monitoring (started in January 2008) is being published in website of dedicated national agency which provide EMF related information to local authorities to rely upon[11,12].

In France, simulations for 2G and 3G networks showed that a reduction of the electric field (down to 0.6 V/m) does not affect coverage quality outside buildings in urban areas (with many available antennas in the neighbourhood), but does so for rural areas. For some "atypical points", levels may reach up to 8.01 V/m in a dense urban area. Simulations of power reduction showed that public exposure may fall down to 3 to 6 V/m depending on the situation, without coverage modification [COMOP 2011].

In Italy, information was gathered through national experts regarding their experience in implementing procedures designed to reduce RF-EMF emissions. The goal was to devise at a national level the methods and techniques that may minimize EMF RF emissions for the same quality of service. It recognizes the importance to establish collaboration between local authorities and operators to implement effective policies [ISPRA 2011][13].

In 1996, Slovenia implemented ICNIRP guidelines from environmental exposure with an additional abatement factor of 10 (0 -300 GHz). It has regulated measurement procedures by mandating the provision of licensing for operators and measurement providers. A study was carried out in 2004 in access the impact of this policy, which suggest that there was no reduction in general risk perception from mobile base stations [ICEF 2004][14]. As an aftermath, a best practice code[15] was launched, to quell the public concern and encourage an open dialogue with public[16].

An exposure measurement survey carried out in New Zealand in 2005 amongst the randomly selected base stations in public accessible areas identified the highest values to be 8.3 μW/cm^2 (1.8% of the public exposure at 450 μW/cm^2)[17,18,19] from a cell phone transmitter.

In the UK, there are provisions for the operators to voluntary display information about the base station via website of independent authority OFCOM. As the provision is voluntary, many operators have ceased providing updates from as early as 2005. An independent expert group reported that no installations, for whom the measurements were carried out, has exceeded 0.005% of the ICNIRP limits[20]. Similarly, to increase transparency in procedure, operators in UK have published "Ten commitments to best siting practice" in August 2001[MOA 2002][21]. To review the progress, a post-implementation review was carried on 2004 and 2005 with significant improvements noticed [Deloitte & Touche 2005][22]

Occupational exposures

While reduction of workers' exposure has been tested for the very low and high frequency fields [Sandström 2006; Bednarek 2010[23]], no relevant data was found regarding policy assessment of occupational exposure, maybe in part due to the fact that the European Directive is not implemented yet.

4.3 Impact on risk perception

Many countries across the world enforce exposure standards lower than the ICNIRP or IEEE guidelines in frequency spectrum (0-300 GHz) primarily based on the principle of precaution, which is based upon socio-political context rather than on scientific evidence ([ICEF 2004]. Adopting stricter regulation does not necessarily pacify the public's concern as illustrated in Italy where citizens continue to demonstrate against mobile base stations even after the reduction of emission limits. A study carried out in Italy identified that in most territories the electrical field strength was below 6 V/m [Troisi 2009][24]

There are opposing views on whether adoption of a precautionary approach for setting public exposure limits increases or decreases the risk perception from RF-EMF. Precautionary measures do not show to reduce risk perception [Wiedemann 2005; 2006; 2013; Barnett 2007], and its application is said as “not appropriate to the policy on the use of mobile phones and the siting of base stations” by some authors [Dolan 2009]. Other authors reckon that understanding of the public remains very complex [Timotijevic 2006][25].

A study in Czech Republic mentions about a group of people living in and around the building with base station, who were concerned about the radiation. Invited to ask for field measurements, they were surprised by the low level of the field intensity [ICEF 2004]. A study carried out in 2009 in France suggest that though majority perceive that there is imminent risk from the base station antennas and mobile phones to health (61% and 59% respectively), only a few (26%) mentioned of changing their habits related to mobile use, which has been attributed to the diminishing trust in authorities and communication from scientists, or lack of understanding of the message (AFSSET 2009[26], IRSN 2009[27]].

A study in Poland carried in 1998-2000 amongst 1000 residents who were demonstrating against settlement of GSM base stations suggest a very high negative correlation between the state of knowledge of bio effects of EMFs and the state of fears from EMFs. People would accept mobile phone base stations as high towers, but not in the rooftops of buildings. The demonstrations were partly ignited by the reports from Polish media on EMF [Krzysztof Wardak 2003].

Studies suggest that differential political organization, governance system and cultural differences may be accounted for the different pattern of risk perception in European countries [AFSSET 2009].

In Latin America, studies on social research and communication on MEF are scarce, and reports published are based on results from Europe, the USA or other non-Latin American countries [Latin America Experts Committee 2010]

4.4 Summary

The literature review identifies that the increase in public exposure to RF fields over the period of years has increased public concern and research interest in the field of health impact from RF EMF exposure but evidence-based benchmarking for local, national or

international policies is limited. It is important that such studies be undertaken and their results made publically available, through institutional web sites and, preferably, through peer reviewed publications, to allow experience sharing and dissemination.

5. ANALYSIS OF POLICY PATTERNS

5.1 Definition of policy patterns

To define and analyse the patterns of risk management policies on RF exposures across the world, it was hypothesized that one could identify 5 possibly overlapping categories of policy profiles: (1) an evidence-based policy approach; (2) a precautionary policy approach; (3) a policy inspired by the ALARA principle; (4) a policy based on a voluntary approach instead of regulations; (5) a policy that gives emphasis to provision of information and consultation procedures.

This policy categorization rests on the answers given to the survey questionnaire and does not judge the relative merits of each approach. A set of questions that contributes to each policy profiles was created (see Annex 3). A value of one is added to the score each time an answer corresponds to the relevant profile. Each country is assigned a total score for each profile, which is the sum of the values across the different questions, and this total score defines a position on the scale of possible extreme values for each profile (from 0 to X, depending upon the number of relevant questions).

To avoid systemic bias in process of scoring, countries that have one or more missing values in the items contributing to the policy pattern scores were excluded from the analysis. All the primary respondent countries meet these criteria of inclusion. Other countries excluded from each topic are explained in Annex 4

5.2 Description of policy patterns

The results of policy patterns are exhibited in the form of histograms for each policy pattern, where each country has a colour code corresponding to its WHO region (Annex 6). The countries are displayed in descending order in accordance with the score obtained. Individual scores obtained by each country in each policy domain are given in Annex 11.

Policies inspired by a precautionary approach

Figure 13 shows the countries according to the emphasis they put on the precautionary approach while setting limits on RF exposure limits and emission levels from mobile

phone and base stations intended in controlled or uncontrolled environment and among the specific groups (pregnant, people with biomedical devices).

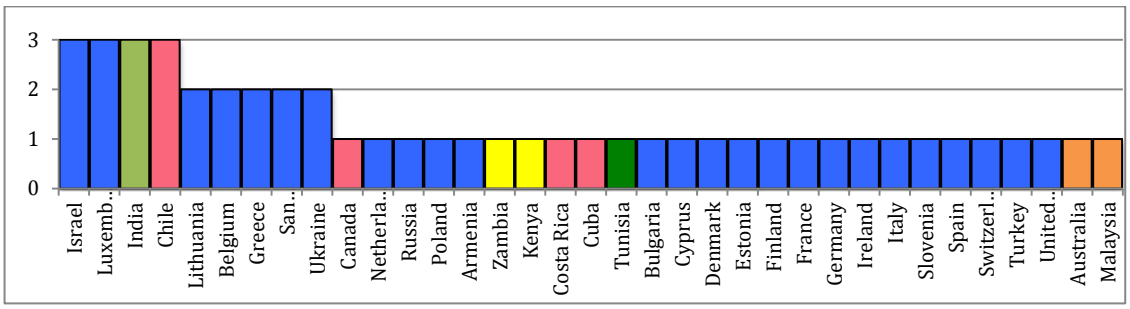

Figure 13: Scoring of countries according to precautionary policies

Policies inspired by an ALARA

Figure 14 exhibit the 4 countries that state their policy is inspired by an ALARA approach. Such policy is rare.

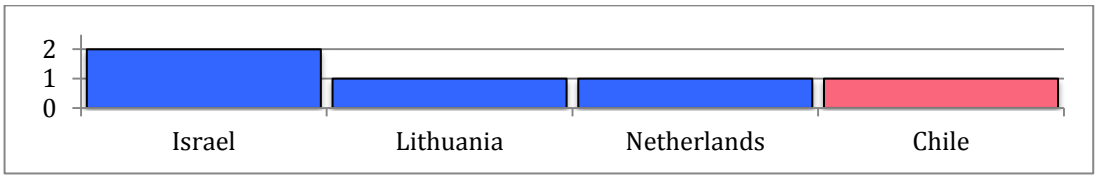

Figure 14: Scoring of countries according to ALARA policies

Information and consultation policies

This policy profile includes countries according to the emphasis they put on the information to users of mobile devices and/or on the development of consultation policies during the installation of radiofrequency emitters of different types (Figure 15).

Evidence-based policies

This policy pattern includes countries that have set their exposure/emission limits for mobile devices and fixed installations and in the occupational settings based on scientific evidence, following either the ICNIRP or IEEE guidelines or science-based recommendations from their own national experts (Figure 16).

Policies inspired by voluntary approaches

Figure 17 exhibits, the countries whose exposure and emission limits for personal, environmental and occupational exposures are based on voluntary provisions.

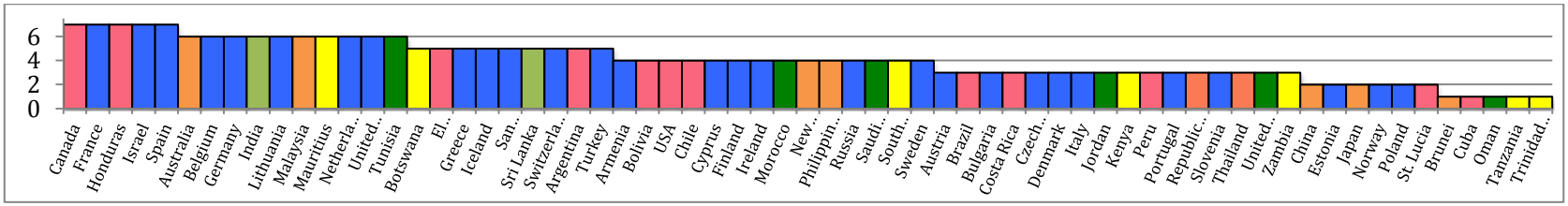

Figure 15: Scoring of countries according to information or consultation based policies

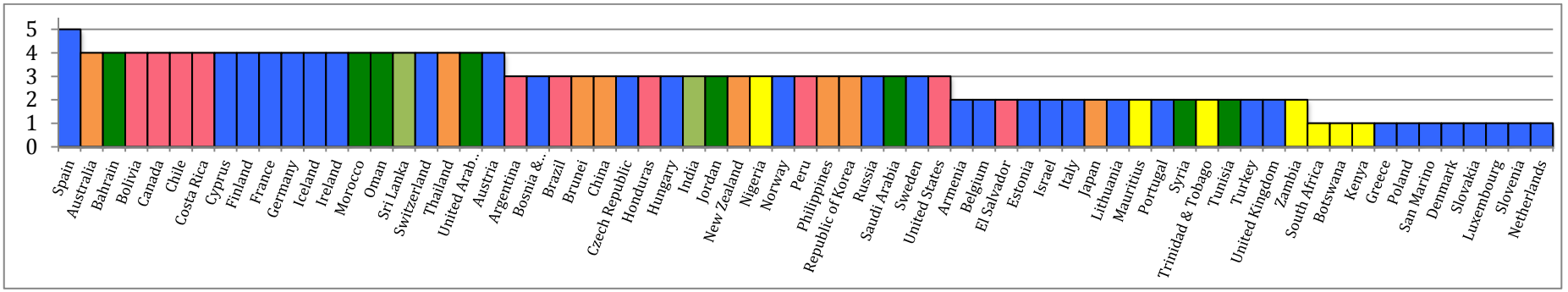

Figure 16: Scoring of countries according to evidence-based policies

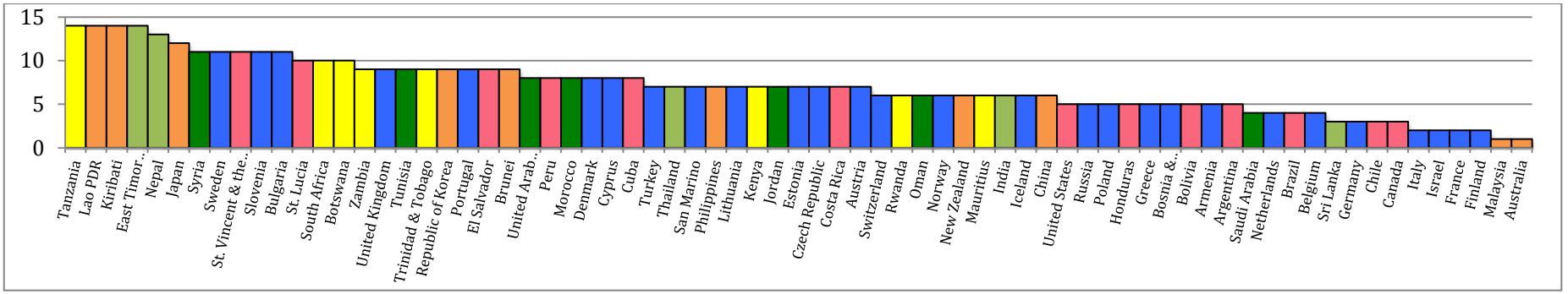

Figure 17: Scoring of countries according to voluntary policies

5.3 Do these policy patterns contrast the different countries?

In general, countries that adopt a precautionary approach to RF risk management, also favour information/consultation policies (N=33, regression p value = 0.02; R^2=0.16) (Figure 18). Countries that adopt a "voluntary approach", on the contrary, tend not to give emphasis to information and consultation procedures (N=63, regression p value = 0.000; R^2=0.26) (figure 19). No statistical association was observed between the evidence-based or precautionary scores, respectively, and the voluntary score (very low R^2 values of 0.07 and 0.04 respectively).

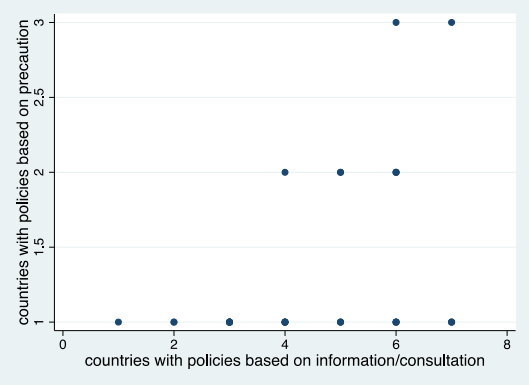

Figure 18: Relationship between the scores of countries according to their "information/consultation" and "precaution based" profiles *(note some countries may have the same scores on both scales so that the number of dots appears less than 33).*

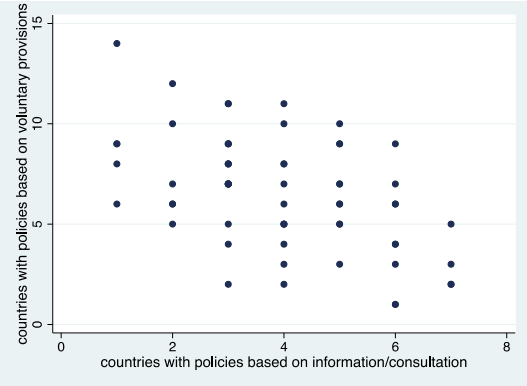

Figure 19: Relationship between the scores of countries according to their "information/ consultation" and "voluntary" profiles.

5.4 Influence of the dissemination of cell phones in the public

Hereafter is assessed whether there is an influence of the penetration of mobile phones in the different countries on the preceding policy patterns. Univariate regression analysis was carried out between the proportions of 'mobile telephone subscriptions per 100 inhabitants' (ITU 2011) in each country with the score of countries in different policy profiles.

For further analysis, we split the proportion of mobile subscribers per 100 inhabitants in each country in five quintiles, which is used for the comparative analysis for practices regarding (i) personal exposures from mobile devices, and (ii) environmental exposures from fixed installations. The quintiles limits are the following: [11.69-84.52]; [87.05-106.08]; [106.48- 116.93]; [117.3-130.97]; and [131.43-191.24]. The policy patterns across these quintiles of countries were assessed via scatter diagram and univariate

regression methods. Five categories of actions showed a statistically significant association (P<0.05) with the proportion of subscribers.

Existence of exposure limits for mobile devices and fixed installations emissions

For these two provisions, countries with a low penetration rate (first quintile) did no set exposure limits; in general, neither for mobile devices users nor for the general public in relation to RF fields from fixed installations. The other countries are more similar, with no evident trend (figures 20 & 21)

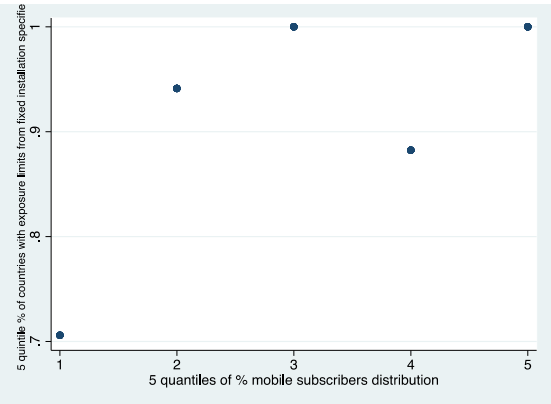

Figure 20 – Relationship between the penetration rate of mobile phones (quintiles of subscribers per inhabitant) and the existence of exposure limits from fixed installations

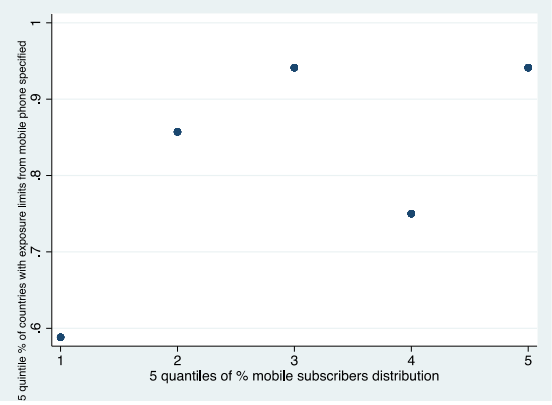

Figure 21 – Penetration rate of mobile phones (quintiles of subscribers per inhabitant) and the existence of exposure limits for mobile devices

Provisions for information on RF exposure by mobile devices

The low subscription rate countries do not have, in general, provisions to inform RF-emitting personal devices on how to reduce their exposure; the other countries tend to adopt such provisions (figure 22).

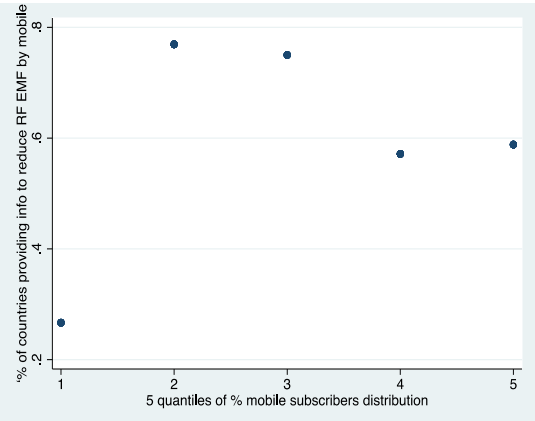

Figure 22: penetration rate of mobile phones (quintiles of subscribers per inhabitant) and provisions to inform on how to reduce RF EMF by mobile devices

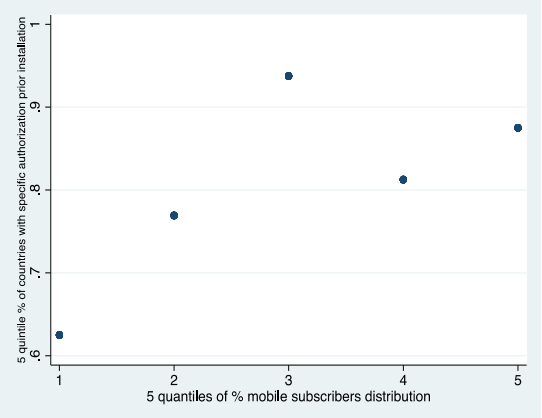

Figure 23: penetration rate of mobile phones (quintiles of subscribers per inhabitant) and provisions for specific authorization prior to establishing fixed installations

Provisions for specific authorization prior to establishing fixed installations.

The countries with a greater penetration rate tend to have more frequently provisions regarding authorization prior to establishing fixed installations but the stronger contrast is again with the countries where the subscription rate is low (Figure 23).

Provisions to request exposure measurements for RF emitted by fixed installations

A similar observation is made regarding provisions for measuring exposure levels of the general public about fixed installations (figure 24).

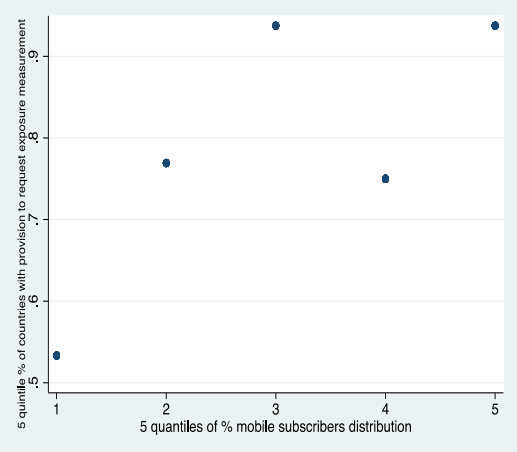

Figure 24: penetration rate of mobile phones (quintiles of subscribers per inhabitant) and provisions on exposure measurements for fixed installations.

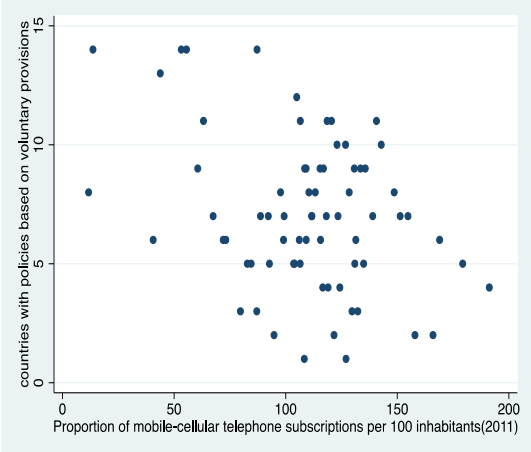

Figure 25: Proportion of mobile-cellular telephone subscriptions per 100 inhabitants and policy profile based on voluntary provisions

In a more general policy analysis, there is a negative correlation between the mobile coverage in the country and the policy pattern that rests mainly on voluntary action by the concerned stakeholders (N=71, regression p-value = 0.003, R-squared = 0.12; Figure 25). The heterogeneity is large, however.

No other policy pattern, i.e. policies prone to precaution, policies prone to Information, evidence based, and ALARA based policies, showed an association with the proportion of mobile subscribers in the country (p= 0.68)

6. DISCUSSION

The study suggests that the majority of respondent countries adopt evidence-based limits, and few countries do not have any policy regarding RF EMF risk management. Results refute the regional pattern across the world, in terms of adoption of exposure limits for personal and environmental exposures, contrary to our hypothesis. In Latin America, all respondent countries except Bolivia followed the ICNIRP guidelines while in North America, both the USA and Canada have their own evidence based national

standards. It should be noted that the Federal Communications Commission of USA adopted the limits of ANSI/IEEE but did not update them when the IEEE limits changed. In Europe, countries in the earlier Soviet bloc have reported stricter limits than ICNIRP but some of them have already started following ICNIRP limits (Slovenia, Lithuania) whereas countries in the Western Europe either followed ICNIRP limits or put an abatement in the ICNIRP limits, for precautionary purposes. In case of African region, the survey participation was low compared to other regions, but the secondary searches suggest that in countries where RF policies are available, they usually adopted the ICNIRP guidelines. In South East Asia, India is the only country to follow a precautionary approach regarding fixed installations. This precaution could be attributed to the growing ICT sector and anxiety associated with it. Overcrowding of BTS installation and proximity of BTS installation in human settlements were given as rationale by the Indian authorities. In western pacific, China was the only country to have its own limits, based on evidence.

This research also suggests that the countries with higher proportion of mobile phone subscriptions are more likely to adopt exposure limits based on science evidence. It supports our hypothesis that countries with higher proportion of mobile phone subscribers are more likely to inform mobile phone users about the possible RF effects and consult with stakeholders in planning matters related to environmental exposure from RF EMF from fixed installations. This could be attributed to the growing public and government concerns on RF EMF.

The tendency to adopt precautionary approach in some countries is meant to abate public fears. This policy is based on political factors rather than on scientific evidence. This have in many cases further contributed to public concerns. Confusion is seen while trying to keep balance between the desire to improve the quality of mobile services and the desire to address public concern on RF EMF. While WHO, being an evidence-based agency, does not recommend specific measures unless proved by rigorous research and consensus among scientists, the view of government and public seems to be lurking between ‘presence’ or ‘absence’ of risk. Alongside, in countries where ICT is in a developing phase, trying to enforce strict policies on BTS installations, without identifying an alternative provisions, could hamper the developmental efforts as it may devoid the countries from adopting new technologies due to public concerns.

While research continues to accumulate, the evidence on the hazard potency of RF EMF is still weak. For the current moment, promoting risk communication and open

dialogue should be taken as a priority. Despite being the most comprehensive survey to date to address policy patterns on RF EMF across the world, unavailability of data from several countries has been a major drawback but as countries influencing the global policies on RF EMF are included, this finding could be generalized to represent the actual scenario of the world.

Ethical Issues

This study involved the analysis of data collected by WHO, by its direct link with the relevant government officials in the member states; therefore, this research did not collect sensitive information on individuals but rather a national level health policy, which were published and often freely downloadable from Internet as well. Meanwhile, all respondents were pre-informed that the results will be published on WHO website. In addition to this, an ethical approval was taken from ScHARR, University of Sheffield and ethical declaration form was filled (Annex 14).

Study Limitations, Reliability and Validity of Data

Classifying patterns of answers from different countries which have totally different socioeconomic context, and comparing them in a same basket is a sensitive issue and since the response were provided by concerned authorities, we could not independently verify the actual policy scenario in that particular country; however, efforts have been made to address this issue through secondary literature review and requesting countries for revalidation of information.

An international seminar was organized on June 5th, 2013 in Paris to present the study findings, where representatives participating from 40 countries were provided the opportunity to make changes to their responses. The information from the survey and comments from representatives of the member states and other stakeholders who attended the Paris seminar will be used by those in charge of preparing the chapter of the EHC monograph dedicated to risk management proposals.

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8. ANNEXES

This Annex consists of several sub categories of annex as listed below:

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Figure 26: Provisions to prevent public access around fixed installations (N=74)

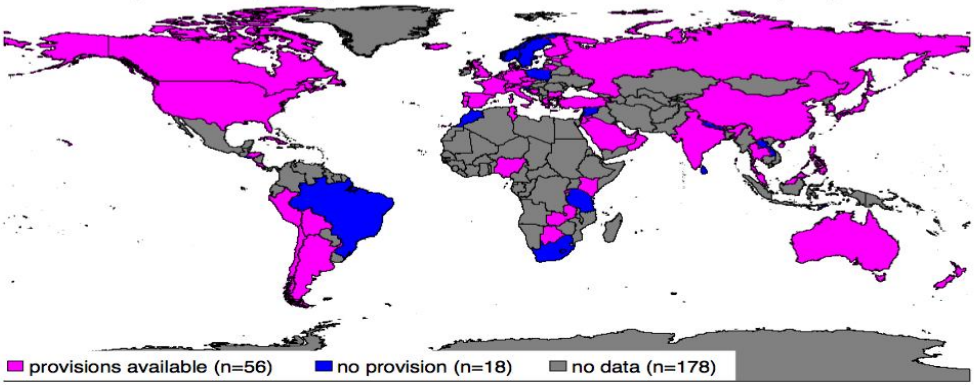


Figure 27: Provision of information to mobile devices purchasers on RF emissions and SAR values (N=76)

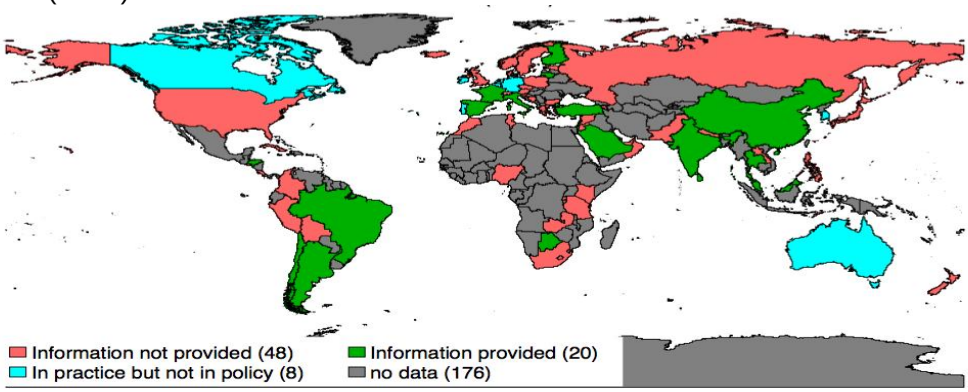


Figure 28: RF emission limits from fixed installations (N=74)

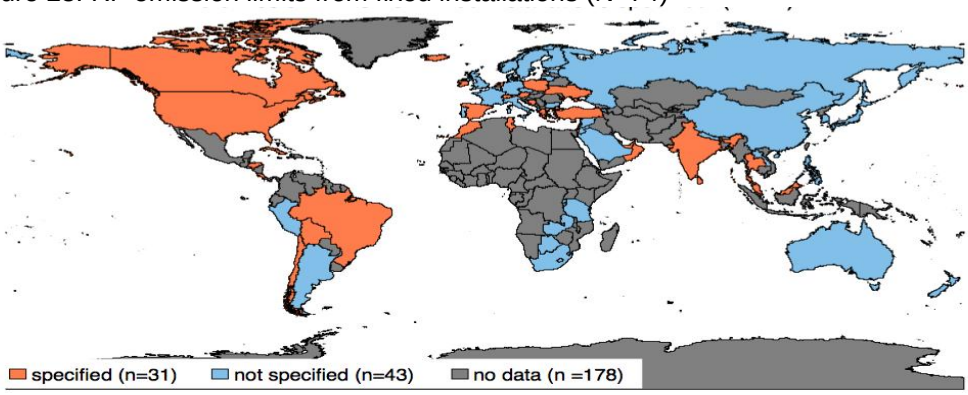


Figure 29: Provisions to limit exposure of maintenance personnel in the telecom sector (N=75)

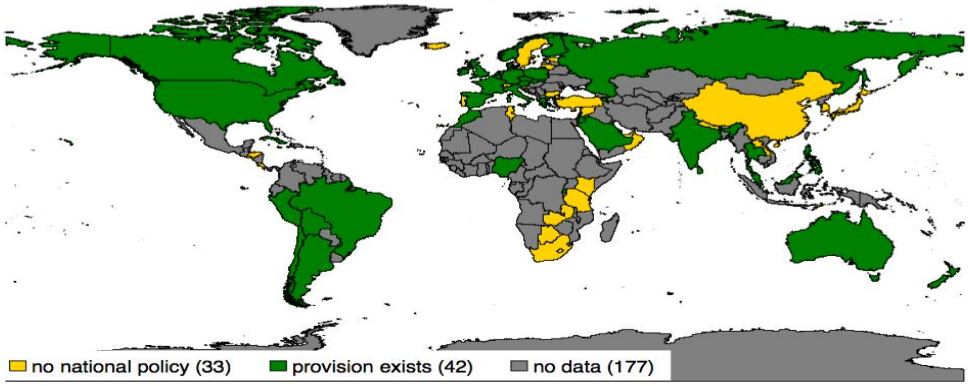


Figure 30: Provisions to keep RF exposure level of worker in the industry (N=74)

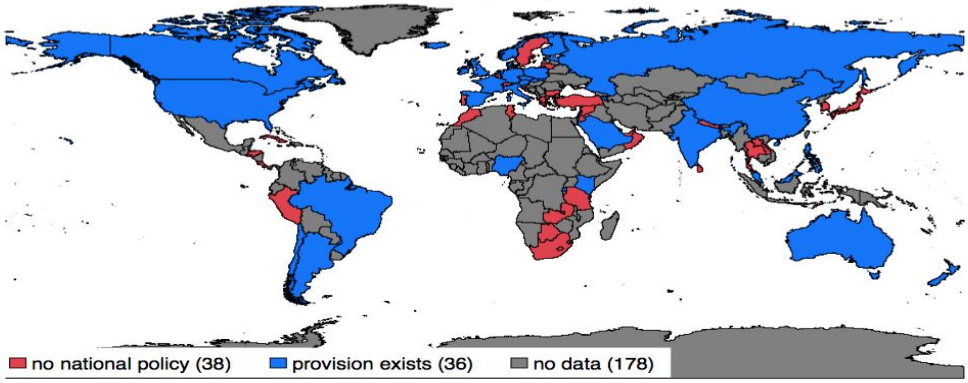


Figure 31: Provisions for worker in the medical sector (N=73)

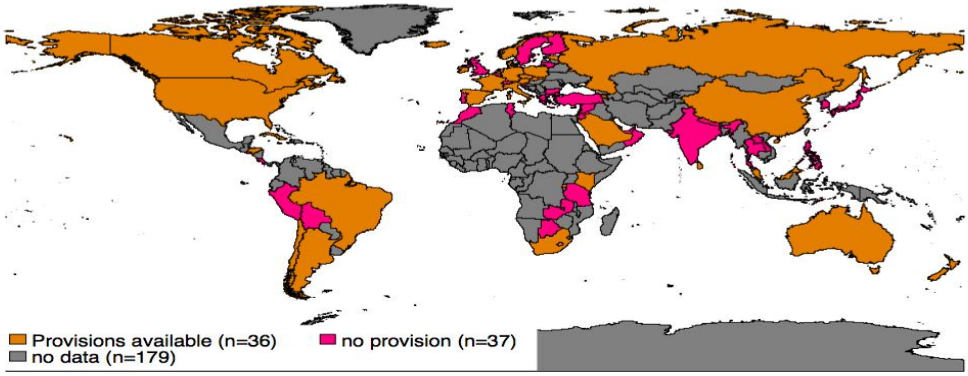


Figure 32: Provision of accreditation scheme for measurement provider

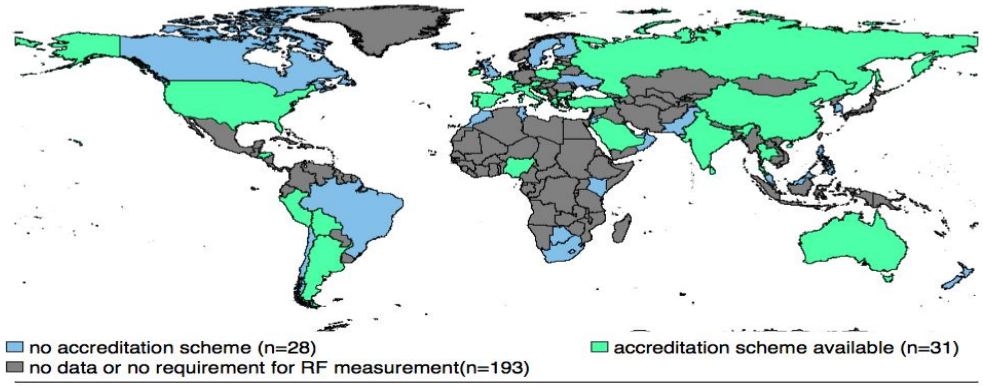


Figure 33: Requirement for recording exposure measurements or modelling estimates (N=75)

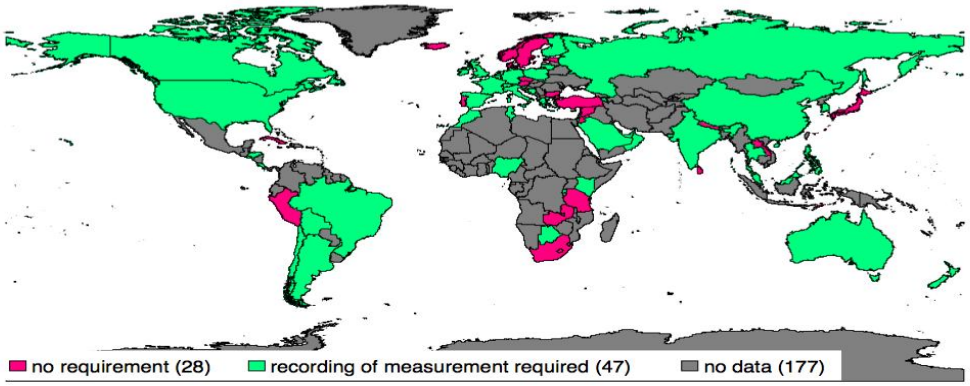


Figure 34: Specific authorization prior to installing a fixed RF installation (N=77)

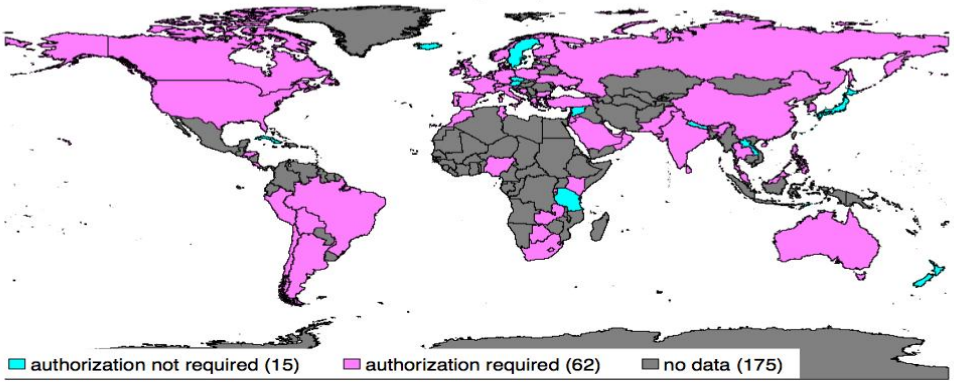
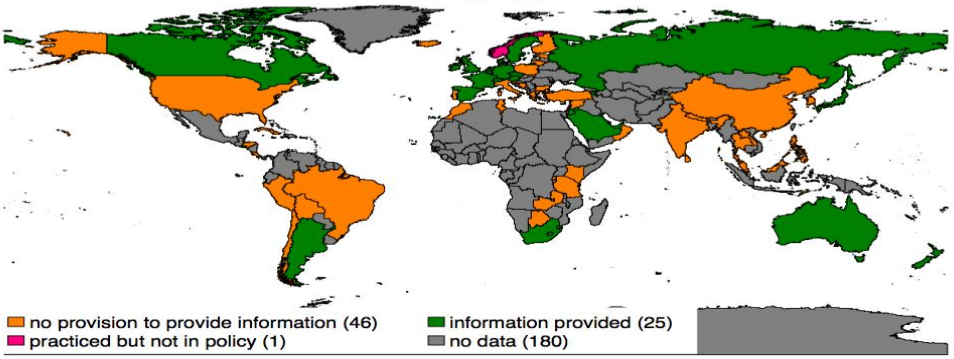


Figure 35: Provision to provide response to persons claiming to be EMF hypersensitive mobile(N=85)



Annex 2: List of tables

Table III: Parties entitled to request RF measurements on fixed installations (N=58)

Entitled parties (Multiple responses)	N	% of cases
National or provincial authorities	49	84.5
Local authorities/ municipalities	36	62.1
Community residents living close to the base station including schools parents	38	65.5
Authorized associations	5	8.6
General public	6	10.3

Table IV: Countries included through secondary search

WHO Region	Countries added through secondary searches (N=14)
Africa	Kenya; Nigeria; Rwanda
Americas	Colombia; Ecuador; Paraguay; Venezuela
Eastern Mediterranean	Pakistan; Iraq; Bahrain
Europe	Ukraine; Hungary, Luxembourg, and Slovak Republic

Table V: Types of literature material according to the policy assessment topic

Topic coverage	Published literature	Grey literature
1. Assessment of exposure levels		
Measurement and modeling guidelines	Simunic 2006.	
Exposure to mobile phones and broadcasting bands	EFHRAN 2010; European commission 2010; ICNIRP 2009; Kim 2010; Mann 2010; Nwankwo 2012; Rowley 2012; Schüz 2000; Viel 2009a; Viel 2009b.	COMOP 2011
Wi-Fi exposure	EFHRAN 2010; Peyman 2011.	
Occupational exposure	European Parliament 2004; Gajsek 2006; Sandström 2006; Hansson Mild 2009.	www.ciop.pl www.consilium.europa.eu www.osha.gov
2. Policy implementation assessment		
Mobile phones	HPA 2012; ISPRA 2011; MOA 2002.	www.bakom.admin.ch www.bipt.be www.esr.cri.nz www.forum-ems.si/ www.gdos.gov.pl www.gios.gov.pl www.gov.uk www.health.govt.nz www.iegmp.org.uk http://sitefinder.ofcom.org.uk www.who.int COMOP 2011; Deloitte & Touche 2003, 2004, 2005.

Occupational exposure	Sandström 2006	Bednarek 2010
3. Impact on risk perception		
	Barnett 2007; Dolan 2009; Erdreich 2001; Krzysztof Wardak 2003; Wiedemann 2005, 2006, 2013.	www.blubus.it http://ec.europa.eu www.elettra2000.it www.wireless-health.org.br AFSSET 2009; ICEF 2004; INPES 2009; Timotijevic 2006; Troisi 2009 IRSN 2009.

ANNEX 3: Policy domains and scoring criteria

Policy Domain	Scoring Questions/Criteria
Information/ Consultation	To be scored in information/consultation, answers for following items need to be "YES" (1) Requirement to provide information on exposure to RF energy to purchasers of mobile devices, (2) Provision to provide information/advice on reducing personal exposure to RF emitted by mobile devices, (3) Provision to provide responses to individuals concerned on possible health consequences of RF exposure from mobile devices, (4) Provision for community/local residents to request RF measurements around fixed installations, (5) Provision for the public to have access to the records on exposure measurements from fixed installations, (6) Requirement to inform/consult with public stakeholders before installing a fixed installation, (7) Provision to provide responses to individuals who have concerns on possible health consequences of exposure to fixed installation (e.g. masts, tower etc.)
Evidence based	To be scored in evidence approach, following items need to based upon science/evidence (1) RF exposure limits from mobile devices for general public, (2) RF exposure limits from fixed installations for general public, (3) RF emission limits from fixed installations, (4) Provision to mandate financial contributions from relevant private sectors towards health-related research on RF fields, (5) Occupational exposure limits to RF for workers.
Precautionary profile	To be scored in Precautionary approach, following items need to based upon precautionary approach (1) Exposure limit from Mobile devices based, (2) Limitations on use of mobile for children, (3) Exposure limits from fixed installations, (4) Emission limits from fixed installations (5) Occupational exposure limits, (6) Occupational provisions for specific groups, (7) Management of occupational exposure to RF fields
ALARA	To be scored in ALARA, following items need to based upon ALARA approach (1) Exposure limit from Mobile devices, (2) Exposure limits from fixed installations, (3) Emission limits from fixed installations, (4) Occupational exposure limits
Voluntary provisions	To be scored in Voluntary provisions, the answers for following items should be "NO" or based upon voluntary provisions: (1) RF exposure limits for general public on mobile devices defined, (2) Requirement to provide information on exposure to RF energy to purchasers of mobile devices, (3) Information/limitation regarding the use of mobile devices by children, (4) RF exposure limits for general public on fixed installations defined, (5) RF emission limits of fixed installations defined, (6) Authorization required prior to installing a fixed installation, (7) Provision on spatial distribution of fixed installations, (8) Requirement to inform/consult stakeholders in the process of installing fixed installations, (9) Provision to mandate financial contribution from

private sectors towards health-related research on RF fields, (10) RF exposure limits in occupational settings defined, (11) Provisions to limit exposure to maintenance personnel in telecom sector, (12) Provisions to limit exposure to workers in industrial sector, (13) Provisions to limit exposure to workers in medical sector, (14) Provisions to limit exposure levels of specific subgroup of workers.

ANNEX 4: Exclusion criteria for policy analysis

Domain	Excluded Countries and Rationale
General Criteria	All Countries with one or more responses missing from the question pertaining to the required domain will be excluded from the study.
Information/consultation	Luxembourg and Nigeria (Out of total 7 scores mentioned above, we had information for only 2 questions)
Voluntary	Pakistan, Colombia, and Nigeria (many missing values for the questions pertaining to voluntary policies)
Science/Evidence based	Pakistan, Iraq, Ecuador, Colombia, Paraguay, Rwanda, Slovakia and Venezuela (removed from analysis as they lack responses to more than one scoring questions). For example, answers from Pakistan for questions relating to “exposure limits from Mobile devices” and “exposure limits from base stations” but no information for other categories of the evidence-based approach "Occupational exposures”, “Financial contribution on EMF research by private sector”, “Emission limits from base stations” and so on. Hence, exclusion was the only option to avoid bias. None excluded for “ALARA and “Precautionary based approach”

ANNEX 5: Keywords used for extracting national literature

Search Strategy 1

Objective: to complete the missing data of primary respondents

- “Name of country e.g. Nepal, Kenya etc.” and “Non ionizing radiation”
- “Name of country” and “Radiation”
- “Name of country” and “exposure limits for mobile base station”
- “Name of the country” and “telecommunication authority”
- “Mobile Phone” and “School” and “Children” and “Name of the Country”
- “Mobile device/phone and Health” and “Name of country”
- “Guidelines on non-ionizing radiation” and “Name of the country”

Search Strategy 2

Objective: To identify responses from key questions from countries, which didn’t participate in the WHO survey.

In addition to Key words for Strategy 1, following Key words were used:

- “Mobile and Health” and “Name of the continent e.g. Africa, Europe etc.”
- “Policy on non-ionizing radiation and “Name of the continent”
- “Exposure limits to mobile phone and/or mobile base station” and “Name of the continent”

ANNEX 6: Keywords used for published and unpublished literature

The keywords here were used for the purpose of literature review for grey and published articles. When a word had different spellings, all were searched. Both singular and plural forms were looked. For example, we searched for RF, radiofrequency, radiofrequencies, radio frequency, radio frequencies, radio-frequency and radio frequencies.

- Adverse health effect
- Concern
- Controversy
- Compliance
- Consumers
- Consumer information
- Consultation Policy
- Effectiveness regulation
- Electromagnetic field
- EMF recommendations
- EMF RF policy
- Evidence/recommendation
- Exposure assessment/evaluation
- Exposure level
- Exposure standard
- Fear
- Guidelines human exposure
- Impact assessment/evaluation
- Impact regulation/policies
- Impact of precautionary measures
- Implementation/installation policies
- Independent review policy
- Occupational exposure
- Occupational standard
- Precautionary measure/principle
- Personal exposure
- Policy assessment/evaluation
- Policy options
- Policy face to scientific uncertainty or controversy
- Post-implementation/post-installation assessment/evaluation/review
- Provision exposure
- Public concern
- Recommendation evaluation/assessment
- Regulatory/federal policy
- Regulatory guides evaluation/assessment
- RF/EMF
- Risk management practices
- Risk perception
- Risk analysis
- Risk communication
- Risk governance
- Rules
- Safety standards
- Social Science
- State response
- Town planning
- Trust
- Voluntary measures/in voluntary measures
- Wi-fi / Wifi / Wi fi
- Mast / antennas / telecommunication / fixed installations / base stations / mobile phones

ANNEX 7: Colour code of countries according to WHO region

Region	European (E)	Eastern Mediterranean (EM)	African (Af)	South-East Asia (SEA)	Western Pacific (WP)	Americas (Am)
Colour						

ANNEX 8: ICNIRP guidelines [ICNIRP 1998; 2010].

ICNIRP is an independent International body that have developed exposure guidelines for workers and for the general public from non-ionising radiation, based on a detailed assessment of the available scientific evidence. WHO recommends the use of ICNIRP guidelines for setting limits for human exposure to radiofrequency electromagnetic fields.

Table VI: Basic restrictions for time-varying electric and magnetic fields for frequencies up to 10 GHz [ICNIRP 1998].

Exposure characteristics	*Frequency range*	*Current density for head and trunk ($mA\ m^{-2}$) (rms)*	*Whole body average SAR ($W\ kg^{-1}$)*	*Localised SAR (head and trunk) ($W\ kg^{-1}$)*	*Localised SAR (limbs) ($W\ kg^{-1}$)*
Occupational exposure	Up to 1Hz	40	/	/	/
	1-4Hz	40/f	/	/	/
	4Hz-1kHz	10	/	/	/
	1-100kHz	f /100	/	/	/
	100kHz-10MHz	f /100	0,4	10	20
	10MHz-10GHz	/	0,4	10	20
General public exposure	Up to 1Hz	8	/	/	/
	1-4Hz	8/f	/	/	/
	4Hz-1kHz	2	/	/	/
	1-100kHz	f/500	/	/	/
	100kHz-10MHz	f/500	0,08	2	4
	10MHz-10GHz	/	0,08	2	4

Note: f is the frequency in Hertz.
rms stands for root-mean-square and SAR for specific absorption rate
The original table has a number of explanatory footnotes; the reader is referred to the original text [ICNIRP 1998].

Table VII: Basic restrictions for power density for frequencies between 10 and 300 GHz [ICNIRP 1998].

Exposure characteristics	*Power density ($W\ m^{-2}$)*
Occupational exposure	50
General public	10

Notes:
- Power densities are to be averaged over any 20 cm2 of exposed area and any $68/f_{1.05}$-min period (where f is in GHz) to compensate for progressively shorter penetration depth as the frequency increases.
- Spatial maximum power densities, averaged over 1 cm2, should not exceed 20 times the values above.

ANNEX 9: IEEE maximum permissible exposure (MPE) limits or the external electric field [IEEE 2005].

IEEE is a professional association of electrical and electronics engineers, they have also developed exposure guidelines for exposure to near and far fields NIR, based on a detailed assessment of the available scientific evidence. WHO recommends the use of IEEE guidelines for setting limits for human exposure to radiofrequency electromagnetic fields.

Table VIII: Basic restrictions and MPEs for frequencies between 100 kHz and 3GHz.

		Action level SAR (W/kg)	*Persons in controlled environments SAR (W/kg)*
Whole-body exposure	Whole-Body Average (WBA)	0.08	0.4
Localized exposure	Localized (peak spatial-average)	2	10
	Extremities and pinnae	4	20

The original table has a number of explanatory footnotes; the reader is referred to the original text [IEEE 2005].

Table IX: MPEs for frequencies between 100 kHz and 300 GHz. MPE for the upper tier (people in controlled environments).

Frequency range (MHz)	*RMS electric field strength (E)[a] (V/m)*	*RMS magnetic field strength (H)[a] (A/m)*	*RMS power density (S) E-field, H-field (W/m^2)*	*Averaging time $\|E\|^2$, $\|H\|^2$ or S (min)*
0.1–1.0	1842	$16.3/f_M$	$(9000, 100\,000/f_M^2)$	6
1.0–30	$1842/f_M$	$16.3/f_M$	$(9000/f_M^2, 100\,000/f_M^2)$	6
30-100	61.4	$16.3/f_M$	$(10, 100\,000/f_M^2)$	6
100-300	61.4	0.163	10	6
300-3000	/	/	$f_M/30$	6
3000-30 000	/	/	100	$19.63/f_G^{1.079}$
30 000-300 000	/	/	100	$2.524/f_G^{0.476}$

Note: f_M is the frequency in MHz, f_G is the frequency in GHz.
RMS stands for root-mean-square
The original table has a number of explanatory footnotes; the reader is referred to the original text [IEEE 2005].

ANNEX 10: List of responders

Country	**Organization**
Argentina	Ministry of Health
Armenia	Ministry of Health
Australia	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
Austria	Federal Ministry of Health
Belgium	(i) Brussels Environment; (ii) Federal Ministry of Health; Flemish Ministry of Environment; Brussels Ministry of Environment; Walloon Ministry of Environment; (iii) Department of Environment, Nature and Energy, Flemish government
Bolivia	Vice Ministry of Telecommunication
Bosnia &Herzegovina	Ministry of Civil Affairs
Botswana	Botswana Telecommunications Authority
Brazil	ANATEL - Agência Nacional de Telecomunicações
Brunei Darussalam	Authority for Info-communications Technology Industry of Brunei Darussalam
Bulgaria	National Centre of Public Health and Analysis; Bulgarian National Programme Committee on NIR Protection; Medical University - Pleven
Canada	(i) Health Canada (ii) Industry Canada
Chile	Institute of Public Health
China	China Academy of Telecommunication Research, Ministry of Industry and Information Technology
Costa Rica	Ministry of Health
Costa Rica	Costa Rican social security body
Cuba	Ministry of Public Health
Cyprus	Ministry of Health
Czech Republic	National Institute of Public Health
Timor-Leste	Ministry of Health
Denmark	Danish Work Environment Authority
Denmark	Danish Health and Medicines Authority
El Salvador	Superintendent of Electricity and Telecommunications SIGET
Estonia	Health Board
Finland	(i) Finnish Institute of Occupational Health; (ii) STUK Radiation and Nuclear Safety Authority
France	(i) INERIS; (ii) Direction générale de la santé DGS EA1
Germany	Federal Office for Radiation Protection
Greece	Greek atomic energy commission- Non ionising radiation office
Honduras	(i) National telecommunications commission; (ii) Ministry of Health; (iii) Ministry of Labour and Social Security
Iceland	Icelandic Radiation Safety Authority (IRSA) - Geislavarnir ríkisins
India	(i) Indian Council of Medical Research;

	(ii) (ii) Department of Telecommunications
Ireland	Health and Safety Authority
Israel	Ministry of Health and Ministry of Environmental Protection
	(i) Ministry of Health
Italy	(ii) Istituto di Ingegneria Biomedica Consiglio Nazionale delle Ricerche / ARPA Piemonte
Japan	Japan EMF Information Center
Jordan	Telecommunications Regulatory Commission
Kiribati	World Health Organization
Laos PDR	Environmental and Occupational Health & Safety Division
Lithuania	Ministry of Health of the Republic of Lithuania
	(i) Malaysian Communications and Multimedia Commission (MCMC)
Malaysia	(ii) Ministry of Health
Mauritius	Information and Communication Technologies Authority
Morocco	Agence Nationale de Réglementation des Télécommunications (ANRT)
	(i) Department of Water Supply and Sewerage
Nepal	(iii) Nepal Telecom
Netherlands	Ministry of Economic Affairs, Agriculture, and Innovation
New Zealand	Ministry of Health
Norway	Norwegian Radiation Protection Authority (NRPA)
Oman	Ministry of Health, Ministry of Environment, Telecommunication Regulatory Authority
	UNIVERSIDAD NACIONAL MAYOR DE SAN MARCOS
Peru	SAC DOSE QC
	Centre for Device Regulation, Radiation Health and Research, Food and Drug Association,
Philippines	Department of Health
Poland	Nofer Institute of Occupational medicine
Portugal	Portuguese Environment Agency
Republic of Korea	Chungnam National University and ETRI
	Department of Non-Ionizing Radiation, Federal Medical Biophysical Center of Federal
Russia	Medical Biological Agency of Russia Radiation Protection
Saint Lucia	Labour Department
St. Vincent & the Grenadines	Ministry of Health, Wellness and the Environment
San Marino	Health Authority - Ministry for Health and Social Security
Saudi Arabia	Communications and Information Technology Commission (CITC)
Slovenia	Institute of Nonionizing Radiation
South Africa	Department of Health
	(i) Ministry of Health, Social Services and Equality
Spain	(ii) Hospital Radio physics
Sri Lanka	Ministry of Health
Sweden	Swedish Radiation Safety Authority
	(i) WHO
Switzerland	(ii) Federal Office for the Environment
Syria	Ministry of Industry
Thailand	Bureau of Occupational & Environmental disease, Department of Disease Control.
Trinidad and Tobago	Ministry of Health
	National Agency of Sanitary and Environmental Control of Products (ANCSEP), Ministry of
Tunisia	Health
Turkey	Turkish Ministry of Health, Cancer Control Department
United Arab Emirates	Ministry of Health
	(i) Telecommunications Regulatory Commission (TRC)
United Kingdom	(ii) Health Protection Agency
Tanzania	Tanzania atomic Energy Commission
United States of America	(i) Occupational Safety and Health Administration
	(ii) Federal Communications Commission
Zambia	Zambia Information and Communications Technology Authority (ZICTA)

ANNEX 11: Individual score of countries in each policy domain

	Policy Domain				
Countries	**Precaution**	**Information**	**Voluntary**	**Evidence Based**	**ALARA**
Argentina	.	5	5	3	.
Armenia	1	4	5	2	.
Australia	1	6	1	4	.
Austria	.	3	7	4	.
Bahrain	.	.	.	4	.

Belgium	2	6	4	2	.
Bolivia	.	4	5	4	.
Bosnia & Herz.	.	.	5	3	.
Botswana	.	5	10	1	.
Brazil	.	3	4	3	.
Brunei	.	1	9	3	.
Bulgaria	1	3	11	.	.
Canada	1	7	3	4	.
Chile	3	4	3	4	1
China	.	2	6	3	.
Costa Rica	1	3	7	4	.
Cuba	1	1	8	.	.
Cyprus	1	4	8	4	.
Czech Republic	.	3	7	3	.
Denmark	1	3	8	1	.
Timor-Leste	.	.	14	.	.
El Salvador	.	5	9	2	.
Estonia	1	2	7	2	.
Finland	1	4	2	4	.
France	1	7	2	4	.
Germany	1	6	3	4	.
Greece	2	5	5	1	.
Honduras	.	7	5	3	.
Hungary	.	.	.	3	.
Iceland	.	5	6	4	.
India	3	6	6	3	.
Ireland	1	4	.	4	.
Israel	3	7	2	2	2
Italy	1	3	2	2	.
Japan	.	2	12	2	.
Jordan	.	3	7	3	.
Kenya	1	3	7	1	.
Kiribati	.	.	14	.	.
Lao PDR	.	.	14	.	.
Lithuania	2	6	7	2	1
Luxembourg	3	.	.	1	.
Malaysia	1	6	1	.	.
Mauritius	.	6	6	2	.
Morocco	.	4	8	4	.
Nepal	.	.	13	.	.
Netherlands	2	6	4	1	1
New Zealand	.	4	6	3	.
Nigeria	.	.	.	3	.
Norway	.	2	6	3	.
Oman	.	1	6	4	.
Peru	.	3	8	3	.
Philippines	.	4	7	3	.
Poland	1	2	5	1	.
Portugal	.	3	9	2	.
Republic of Korea	.	3	9	3	.
Russia	1	4	5	3	.
Rwanda	.	.	6	.	.
San Marino	2	5	7	1	.
Saudi Arabia	.	4	4	3	.
Slovakia	.	.	.	1	.
Slovenia	1	3	11	1	.
South Africa	.	4	10	1	.
Spain	1	7	.	5	.
Sri Lanka	.	5	3	4	.
St. Lucia	.	2	10	.	.
St. Vincent & the	.	.	11	.	.
Sweden	.	4	11	3	.
Switzerland	1	5	6	4	.
Syria	.	.	11	2	.

Tanzania	.	1	14	.	.
Thailand	.	3	7	4	.
Trinidad & Tobago	.	1	9	2	.
Tunisia	1	6	9	2	.
Turkey	1	5	7	2	.
Ukraine	2	.	.	.	.
United Arab	.	3	8	4	.
United Kingdom	1	6	9	2	.
United States	.	4	5	3	.
Zambia	1	3	9	2	.

ANNEX 12: Survey questionnaire

Risk Management Policies regarding Radiofrequency Electromagnetic Fields

There has been growing concern about the possibility of adverse health effects resulting from exposure to radiofrequency (RF) electromagnetic fields, such as those emitted by wireless communication devices and networks. In response to such concern, the World Health Organization is assessing health risks that may be associated with exposure to RF fields in the frequency range of 100 kHz to 300 GHz.
This survey seeks to gather information on current risk management policies on RF fields at national level from relevant governmental bodies (e.g. Ministry of Health, Ministry of Environment, Ministry of Telecommunications, Ministry of Labor, Radiation Protection Agency, …). Please feel free to forward this survey to whom it may concern in your country.

The survey has 3 sections reflecting the following RF exposure categories:
Personal exposures associated with the use of mobile devices (such as cell phones)
Environmental exposures associated with fixed installations transmitting signals from radio, television and wireless communication networks, and occupational exposures in the telecom, industrial and medical sectors

The results of this survey will be made publicly available on WHO's website. If you have questions, please contact us at emfproject@who.int. Thank you in advance for completing this survey by 8 October 2012.

NOTE: The mention of actions/policies in this survey does not constitute endorsement by WHO that risks exist or that the actions are appropriate. Merely, they represent examples of actions/policies that are in effect or that have been proposed in some countries.

Fields marked with an asterisk (*) are mandatory.

1. Policies on Personal Exposures from Mobile Devices (e.g. cell phones, home or office cordless phones, baby monitors and other wireless communication devices)

1.1 National Regulation

1.1.1 - Have exposure limits for the general public been specified regarding RF energy produced by mobile devices? (Note: usually given in terms of Specific Absorption Rate (SAR) – the rate of radiofrequency energy absorption per unit mass of the body)Yes/No (click here to proceed to 1.1.2)
If yes, are they based on international recommendations (International Commission on Non-Ionizing Radiation Protection (ICNIRP), Institute of Electrical and Electronics Engineers (IEEE))?Yes/No
If yes, please specify which recommendations, and the corresponding SAR limits (in W/kg) and applicable RF frequency range.
If no, i.e. the exposure limits are different from international guidelines, please specify the applicable exposure limit values and the rationale for these limits (precautionary approach, the ALARA (As Low As Reasonably Achievable) principle, other)?

1.1.2 - Is there any requirement that information on exposure to RF energy be provided to purchasers of mobile devices? (Note: usually given in terms of SAR values in W/kg)Yes/No
If yes, where must the SAR value be displayed?

On the device itself	On the packaging box
In the information pamphlet delivered with the box	On the product shelf
On an Internet site whose address is provided	If other, please specify

1.1.3 - Are there restrictions regarding the use of mobile devices by children? Yes/No
If yes, please give details on the rationale and the provisions (e.g. age limit, restrictions on advertisement, information for parents, restrictions of usage in schools)

1.1.4 - Are there restrictions regarding the use of mobile devices while driving? Yes/No
If yes, is non-compliance subject to fines or prosecution? Yes/No

1.2 Information

1.2.1 - Is there any provision for a national/regional governmental body to provide information/advice on reducing personal exposure to RF fields emitted by mobile devices?

Yes/No (click here to proceed to 1.2.2)
If yes, to whom is the information/advice addressed?
The whole population People equipped with biomedical devices
Pregnant women Children If other, please specify
Who is the information/advice given by? (e.g. Ministry, health agency)
What type of information/advice is given? (e.g. use of a hands-free kit)
How is the information/advice delivered? (e.g. in device user manual, through radio or TV messages)

1.2.2 - Is there any provision, at national/regional levels, to provide a response to individuals who have concerns about possible health consequences of RF exposure from mobile devices? Yes/No
If yes, please specify the type(s) of provisions that are taken

1.2.3 - Other topics deemed appropriate on the management of public exposure to RF fields from mobile devices

2. Policies on Environmental Exposures from Fixed Installations (e.g. wireless telecommunication base stations for cell phone/WiMax/WiFi technologies, smart meters, radio and television transmitters, aeronautical services)

2.1 National regulation

2.1.1 - Have exposure limits for the general public been specified regarding RF energy produced by fixed installations in areas accessible to the public? (Note: usually given in terms of power density in W/m2 or in terms of electric field values in V/m)Yes/No (click here to proceed to 2.1.2)
If yes, are they based on international recommendations (International Commission on Non-Ionizing Radiation Protection (ICNIRP), Institute of Electrical and Electronics Engineers (IEEE))? Yes/No
If yes, please specify which recommendations, and the corresponding values and applicable RF frequency range. If no, i.e. the exposure limits are different from international guidelines, please specify the applicable exposure limit values and corresponding RF frequency range, and the rationale for these exposure limits (precautionary approach, ALARA (As Low As Reasonably Achievable) principle, other)?

2.1.2 - Have emission limits been specified for fixed installations? (Note: this relates to RF emissions of installations rather than exposure of people) Yes/No
If yes, please specify the applicable emission limits, the corresponding RF frequency range and the rationale for these exposure limit values (precautionary approach, ALARA (As Low As Reasonably Achievable) principle, other)?

2.2 Control of exposure

2.2.1 - Is there any provision to prevent public access to areas around fixed installations (e.g. roof of building, adjoining balconies)? Yes/No
If yes, please specify the type of control applied (e.g. fence, warning signs or notices)

2.2.2 - Are RF measurements requested around fixed installations? Yes/No
If yes, who may request such measurements?
The national or provincial authorities The local authorities (municipalities)
The community living close to the base station If other, please specify
Who pays for the measurements?
Who is required to make the measurements (e.g. a local representative of a national dedicated agency, an accredited private company, other)?
Is there an accreditation scheme for the measurement provider? Yes/No
Is the use of a standardized measurement protocol mandatory? Yes/No
If yes, please specify the protocol and, if available, a link to the document.

2.2.3 - Is there any requirement for recording exposure measurements (or modelling estimates) of fixed installations and related information (e.g. location, technical specifications)?Yes/No
If yes, please specify which fixed installations are concerned.
Who has access to the records?
A dedicated national agency The national or provincial authorities
The local authorities (municipalities) The public (through Internet)

2.3 Town planning

2.3.1 - Is there any specific authorization required prior to installing a fixed installation (in addition to meeting technical requirements such as power limitation and operating frequency)?Yes/No
If yes, please specify which type of installations the authorization applies to? (e.g. base stations, WiFi access points, smart meters)
Please specify which location the authorization applies to (e.g. all locations vs. close to specific locations (schools, hospitals, parks) or inside public areas (libraries, airports, train stations).
Who delivers the authorization?
A dedicated national agency The national or provincial authorities
The municipality where the transmission system is to be installed If other, please specify

2.3.2 - Is there any provision, at national/regional levels, regarding the spatial distribution of fixed installations in urban areas? Yes/No
If yes, please give a brief description (e.g. collocation of different operators, siting of macro-or micro cells).

2.3.3 - Are there requirements for informing/consulting stakeholders in the process? (e.g. through public meeting or information session, newspaper advertising)Yes/No If yes, please specify
Who are the stakeholders? (e.g. adjacent land owners, local community, action groups, workers or community near the WiFi access point or smart meter)

2.4 Information and research

2.4.1 - Is there any provision, at national/regional levels, to provide a response to
Individuals who have concerns about possible health consequences of exposure to fixed installations? Yes/NoIf yes, please specify the type(s) of provisions taken

2.4.2 - Is there any provision, at national/regional levels, to provide a response to individuals claiming to be hypersensitive to RF fields? Yes/No
If yes, please specify the type(s) of provisions that are taken (e.g. registration in a database for medical research or for handicap recognition, advice to reduce exposure, assistance with EMF measurements)?

2.4.3 - Is there any national provision to mandate or encourage financial contributions from the relevant private sector(s) toward health-related research on RF fields? Yes/No If yes, please specify the type(s) of provisions taken

2.4.4 - Other topics deemed appropriate on the management of public exposure to RF fields from fixed installations

3. Policies on Occupational Exposures (e.g. associated with radar, microwaves, telecommunications and RF industrial processes)

3.1 - Have exposure limits been specified for trained workers in their occupational environment?
Yes/No (click here to proceed to 3.2)
If yes, are they based on international recommendations (International Commission on Non-Ionizing Radiation Protection (ICNIRP), Institute of Electrical and Electronics Engineers (IEEE))? Yes/No
If yes, please specify which recommendations, and the corresponding values and applicable RF frequency range. If no, i.e. the exposure limit values are different from international guidelines, please specify the applicable exposure limits for the various occupational sectors (e.g. telecommunication, industrial, medical)

3.2 - Are there provisions to limit exposure of maintenance personnel in the telecommunications sector when operating on fixed wireless broadband base stations, TV or radio broadcasting towers and radio-relay links? (Note: this question refers only to radio technicians or engineers, or other staff who have received training on RF safety) Yes/No
If yes, please specify what provisions are taken (e.g. reduction or transitory cessation of the emissions of the concerned and/or co-located transmitters)

3.3 - Are there provisions to keep RF exposure levels of workers in the industrial sector using processes involving RF fields (e.g. induction heating or dielectric welding) under occupational exposure limit values? Yes/No
If yes, please specify what provisions are taken (e.g. training, use of appropriate signs/warnings, engineering or administrative controls, medical surveillance)

3.4 - Are there provisions to keep RF exposure levels of workers in the medical sector (e.g. physiotherapists) under occupational exposure limit values? Yes/No
If yes, please specify what provisions are taken (e.g. training, use of appropriate signs/warnings, engineering or administrative controls, medical surveillance)

3.5 - Are there provisions to restrict exposure levels of specific subgroups of workers (e.g. female workers who have declared their pregnancy to their employer, workers having electro-medical devices that may interfere with occupational EMF fields)? Yes/No If yes, please specify what provisions are taken

3.6 - Other topics deemed appropriate on the management of occupational exposures to RF fields

*Contact and Organization Details Country * Organization name *Last name *First name *Title/Function * Email **

ANNEX 13: Ethical Declaration

Ethical Declaration form from University of Sheffield as a requirement of European Public Health Masters Degree (next page)

Department of Economics/ScHARR

Research Ethics Review
for Undergraduate and Postgraduate-Taught Students

Form 1C: Student Declaration

To be included in Appendices of dissertation

Research Project Title: International survey on risk management policies regarding Radiofrequency Electromagnetic Fields

Name of dataset to be used: not applicable

Owner of dataset: World Health Organisation

Total number of datasets to be used: .....1...
If more than one, then fill in a separate declaration for each dataset.

State the case that applies to your research project: Case …2…..

Case 1: Your proposed project will only involve data that any member of the public is legitimately free to access and use without having to obtain permission from anyone else. E.g., macroeconomic statistics provided by legitimate sources such as government departments and international organisations; anonymised secondary data on individuals or firms provided by legitimate sources such as government departments and which do not require any form of registration or statement of purpose to allow access.

Case 2: Your proposed project will involve secondary data for which you need to obtain permission from the owner (e.g., you need to satisfy some condition before being permitted to download the data, such as a declaration of intended educational purpose. Downloading the BHPS from the Data Archive falls in this category.)

Case 3: None of the above cases. Note that the department does not allow undergraduate or postgraduate taught students to use primary data unless specific training is undertaken by the student.

If your proposed project falls within Case 1, then simply print your name, date and sign below.
If your proposed project falls within Case 2, then you need to append to this form evidence that you have legitimately obtained access to these data. E.g., confirmation email, and statement of purpose if one was required. Then print your name, date and sign below.

If your proposed project falls within Case 3, then contact your supervisor or supervisory team as soon as possible. You may not be able to use the proposed data.

Name of student: Amit Dhungel

Signature of student:  **Date: 26th January 2013**

Name of supervisor: Denis Zmirou-Navier

Signature of Supervisor:

Date: 3 February 2013

ANNEX 14: Endnotes

[1]http://www.emf-portal.de/
[2]http://www.ciop.pl/17474 as of 14 May 2013.
[3] http://www.ehjournal.net/content/pdf/1476-069X-7-54.pdf as of 14 May 2013.
[4]http://www.developpement-durable.gouv.fr/IMG/pdf/Rapport_COMOP.pdf as of 14 May 2013.
[5]http://www.ciop.pl/17470 as of14 May 2013
[6]http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:184:0001:0009:EN:PDF as of 15 May 2013.
[7]http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/lsa/136706.pdf of 24 May 2013.
[8]http://www.bakom.admin.ch/dokumentation/zahlen/00545/00547/00548/index.html?download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1ad1IZn4Z2qZpnO2Yuq2Z6gpJCDdH17f2ym162epYbg2c_JjKbNoKSn6A--&lang=en as of 24 May 2013.
[9]http://www.bipt.be/en/425/ShowDoc/3912/Communications/Communication_of_the_BIPT_Council_of_15_February_2.aspx as of 24 May 2013.
[10]http://www.hpa.org.uk/webc/hpawebfile/hpaweb_c/1317133827077 as of 14 May 2013.
[11]http://www.gios.gov.pl/artykuly/154/Monitoring-pol-elektromagnetycznych as of 24 May 2013.
[12]http://www.gios.gov.pl//zalaczniki/artykuly/ocena_PEM_2009.pdf as of 24 May 2013.
[13]http://www.isprambiente.gov.it/it/pubblicazioni/rapporti/monicem-monitoraggio-e-controllo-dei-campi as of 24 May 2013.
[14]http://www.who.int/peh-emf/meetings/archive/en/slovenia04_abstracts.pdf as of 14 May 2013.
[15]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11486/codemobilenetwork.pdf as of 14 May 2013.
[16]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11486/codemobilenetwork.pdf as of 14 May 2013.
[17]Value recommended in the New Zealand Standard 2772.1:1999 Radiofrequency Fields Part 1: - Maximum exposure levels 3 kHz - 300 GHz (http://www.health.govt.nz/our-work/radiation-safety/non-ionising-radiation/radiofrequency-field-exposure-standard)
[18]http://www.esr.cri.nz/competencies/nrl/faq/Pages/nrlvodafonemonitoringproject.aspx as of 14 May 2013.
[19]http://www.esr.cri.nz/competencies/nrl/faq/Documents/summary-apr04-mar05.pdf as of 24 May 2013.
[20] http://www.iegmp.org.uk/ as of 24 May 2013.
[21]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11486/codemobilenetwork.pdf as of 15 May 2013.
[22]http://www.mobilemastinfo.com/images/stories/documents/news/Ten_Commitments_to_best_siting_practice/deloitte_240105.pdf as of 15 May 2013.
[23] http://www.ciop.pl/37950 as of 14 May 2013.
[24]http://www.elettra2000.it/pdf/reports/pubblicazioni2009/the%20italian%20electromagnetic%20field%20monitoring%20network%20-%20revised%203.pdf as of 24 May 2013.
[25]http://dspace.brunel.ac.uk/bitstream/2438/3948/3/Fulltext.pdf as of 15 May 2013.
[26]http://www.afsset.fr/upload/bibliotheque/964737982279214719846901993881/Rapport_RF_20_151009_l.pdf as of 15 May 2013.
[27]http://www.irsn.fr/FR/IRSN/Publications/barometre/Documents/irsn_barometre_2009.pdf as of 15 May 2013.